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THE LAW AND CHEMISTRY OF FERTILIZERS.

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INTRODUCTION.

THE main object of a fertilizer law* is to ensure that the purchaser of artificial fertilizer, who is usually a farmer, shall obtain an article of the precise quality that the vendor contracts to supply. This quality is stated in what is called an "invoice certificate" or "invoice," usually a printed statement of the percentages of one or more of the valuable fertilizer ingredients—nitrogen, phosphoric acid, and potash—which are present in the fertilizer sold.

Protection is intended to be afforded to the purchaser by the invoice certificate being regarded in law as a warranty guaranteeing the composition of the fertilizer as stated, and making the issue of false invoice certificates punishable. It should be obvious that any protection provided by this means is dependent on the knowledge of the purchaser in selecting the mixture of ingredients which he desires to purchase. If, as usually happens, the farmer does not understand exactly what he wants to buy the vendor can recommend any mixture, and will, of course, see that he recommends something which he has to sell and the composition of which he is sure of. The purchaser being usually unconscious of the meaning of the invoice certificate, it is hardly likely

*Several of the laws mentioned in this article contain provisions dealing with such materials as feeding-stuffs and insecticides, which, being foreign to the subject here treated, have accordingly not been mentioned.

that the vendor will go to the unnecessary risk of issuing a false one; in fact, most of the cases of false invoice certificates hitherto detected in New Zealand are due either to carelessness or accident rather than to intention.

It frequently happens in other circumstances that a person has to act without understanding what he is doing—for example, in signing a legal document or in taking medicine; but in these cases he has the advice of a professional man on whom the responsibility of the methods employed rests, the client or patient, as the case may be, being merely cognizant of the result to be achieved. The weak link in the application of fertilizer law is that the farmer has no handy disinterested adviser to turn to, and his early training in science usually has not been of the standard to enable him to cope with the technicalities of the fertilizer business when they lead him into the domain of mathematics, physics, and chemistry. These sciences should be taught the boy at college up to a standard sufficient to help him in after-life, when it is improbable that he will be able successfully to study them.

The request is frequently made that the terms used in the fertilizer Acts should be simplified. This is, of course, impracticable. Scientific terms are necessary because they are exact. When it is found necessary to apply an unfamiliar word to denote a particular ingredient it is in order that no other meaning shall be taken from that word. To use a word which may mean more than one thing is ambiguous, and may be interpreted in any dispute to the farmer's disadvantage, as the defendant would naturally claim the benefit of any doubt.

With this introduction the writer will commence a brief description of the fertilizer law in force in the United Kingdom and the Dominions, again reminding the farmer that a comprehension of the chemistry of the fertilizers, or the advice of a person having such knowledge, is essential to one who desires to obtain adequate protection from the law.

GENERAL PROCEDURE.

Artificial fertilizers or manures are supposed to contain in concentrated quantities one or more of three elements, the addition of which in the combined states to soils has proved from numerous experiments in field and laboratory to be more beneficial than that of any of the other common elements. These three elements are nitrogen, potassium, and phosphorus, the two latter known in the combined states as potash salts and phosphates respectively, and the first-named as nitrates, ammonium salts, or merely as combined nitrogen contained in animal or vegetable matter.

A purchaser with a knowledge of the composition of the fertilizers on the market and a knowledge of the requirements of his soil should proceed in the following manner. He would first obtain from all sources the current prices of artificial mixed and unmixed (simple) fertilizers. From these prices he would then determine whether it would pay him to buy the simple fertilizers such as superphosphate, dried blood, nitrates, ammonium salts, and potash salts, and to mix these on the farm with a certain amount of diluent or filler such as sand, limestone, or other dry granular matter, or whether it would be preferable to purchase the ingredients already mixed and diluted ready to sow or distribute at once. If he decides on the latter course there

are two alternatives open to him: he may either purchase some brand he recognizes as having given or being likely to give good results on his soil, or he may ask the vendor to make up such a mixture as he deems suitable, and may prescribe the quality and quantity of the ingredients to be used. This latter method is seldom employed and is for various reasons discouraged by the vendors. The purchaser having selected the brands he intends to use, and being assured that if they are up to standard the mixture is what he wants, the function of the fertilizer law comes into play—namely, to ensure that the chemical and mechanical composition is such as is represented by the vendor, it being a necessary provision of all fertilizer laws that the vendor shall sell only on a guaranteed analysis, a copy of which must be given to the purchaser at the time of the sale. As neither farmer nor merchant is competent to determine the truth of the matters stated in the invoice certificate, recourse to a professional man—an analytical chemist, termed an "analyst" or "agricultural analyst"—is necessary.

Every fertilizer law lays down an exact procedure to be followed in order that the analyst shall obtain a sample which accurately represents the bulk of any particular brand if taken from the store, or of any particular consignment if taken from the farmer's premises or in transport to those premises. The important points to be observed in detecting breaches of this type, and to be proved to the satisfaction of the Court when prosecuting, are (1) that the sample was obtained under circumstances which leave no doubt in the mind of the Magistrate that the sample was a fair one, (2) that the sample shall be analysed by an official analyst, and (3) that the vendor or his representative had an opportunity of being present at the taking of the sample and had the offer of a sealed portion for analysis by his own analyst. Cases of dispute between the official analyst and the vendor's analyst as to the composition of the fertilizer are to be settled by reference of a third portion of the sample (which has been reserved untouched) to a third analyst.

In describing briefly the process of detecting and convicting a vendor of selling fertilizer to the prejudice of the purchaser the following would probably be the sequence of events. A farmer, say, complains that in his opinion a fertilizer he has bought is not of the quality expected. He may be led to this conclusion by the appearance of the consignment on arrival at his farm (in which case the inspector, if promptly notified, may take an official sample of that very consignment as well as one from the vendor's store); or he may come to his decision that the fertilizer is ineffective through watching its influence on the growing crops. In the latter case weeks or months may elapse before a complaint is received by the administrative authority, and then, the fertilizer having been all used, or at any rate too long stored by the farmer to permit of a legal sample being taken, the inspector has now to endeavour to obtain a sample from the vendor's store, probably only to find that all that particular line has been distributed.

Assuming that the inspector is successful in finding the identical brand of fertilizer in store, he has to open, say, 10 per cent. of the packages and remove a portion from each, subsequently mixing them and reducing the whole to a small representative sample to be parcelled up and sealed in three labelled packages (all of which must be done in the presence of the vendor or his representative), finally giving one

portion to the vendor, one to the official analyst, and retaining one as a reference sample to be dealt with as events may determine.

The analyst has now to analyse the sample and issue a report, on which proceedings are taken if any material deficiency is found. To keep further check on the brands of fertilizer on sale and on the vendors and manufacturers, in several of the Dominions a system of annual registration of fertilizer brands and vendors, and even of licensing vendors, has been adopted.

FERTILIZER LAW OF THE UNITED KINGDOM.

In the Fertilizers and Feeding-stuffs Act, 1906, no registration of fertilizer brands or licensing of fertilizer vendors is prescribed, neither is there any provision for the branding or labelling of bags or packages containing fertilizer. Every person who sells fertilizer must give the purchaser an invoice, which has the effect of a warranty, stating the percentages of valuable constituents present. These percentages must not differ from those stated within the prescribed limits of error. The unit values of these constituents are not required to be stated. Provision is made that where any fertilizer is made up at the request of the purchaser it will be sufficient compliance with the Act to state in the invoice the composition of the ingredients before mixing. Analysts may be appointed by local bodies, but the approval of the Minister of Agriculture must be obtained to any appointment, and the analyst while holding such an appointment must not become interested in any business which is connected with the sale of fertilizers or feeding-stuffs.

A purchaser of fertilizer may, on payment of the prescribed fee, accompanied by the sample and a copy of the invoice or warranty, obtain of any sample, however taken, an official analysis from the local agricultural analyst. If the sample is likely to be the basis of proceedings under the Act it must be taken within ten days after he has received the fertilizer or the invoice certificate from the vendor (whichever is the later), or under like conditions he may request the official sampler to take the sample. The sample must be divided into three parts, and marked, sealed, and fastened up if it is anticipated that legal proceedings against the vendor may follow, two portions being delivered or sent by post to the analyst and one portion to the seller. The analyst must report to the sender of the sample, stating, *inter alia*, in what respect, if any, the warranty is false and to the prejudice of the purchaser, and if the sample has been taken with a view of instituting proceedings against the vendor the analyst must retain one of the parts and must give a certificate of analysis in the prescribed form to both the purchaser of the sample and to the seller of the sample.

The invoice certificate or any advertisement or circular concerning the fertilizer is to rank as a warranty. The analyst's certificate is to be taken as evidence of the facts stated therein unless the defendant requires that the analyst be called to give evidence. The Act specifically states that proceedings cannot be instituted on samples which have not been taken in the prescribed manner, nor divided, marked, sealed, or fastened up into three parts as prescribed. Either party may object to the local analyst's certificate, and may on payment of

a fee be entitled to have the part of the sample retained by the analyst analysed by the Chief Government Analyst, who is to be supplied with a copy of the invoice certificate.

The Ministry of Agriculture has power to make regulations defining the qualifications to be possessed by analysts, the methods they shall use, the manner of taking samples, and generally for carrying out the Act. Several local bodies may contribute to appoint one analyst and apportion his salary and expenses among them. Some specified local bodies may contribute towards the expenses incurred in this class of work by any agricultural body or association. They may fix the scale of fees payable for analysis or for taking samples.

Failure of the vendor to give an invoice certificate or the giving of a false invoice is punishable, the maximum penalty being £20 for a first offence and £50 for subsequent ones. The vendor is not liable (1) if he did not know and could not with reasonable care have ascertained that the invoice was false, or (2) if he relied on an invoice given by a person in the United Kingdom. It is no defence that a person having bought for analysis was not prejudiced by the sale, but it is a good defence to prove that the sample was improperly taken. The consent of the Ministry of Agriculture is required before any prosecution is instituted. This consent is not to be given until the sample is analysed by the Chief Analyst. The summons is not returnable in less than fourteen days. A penalty is prescribed for tampering with a sample or with the fertilizer itself to procure that an incorrect sample shall be taken. A penalty of £20 or six months' imprisonment is prescribed for refusing to allow an officer to take a sample, or of £10 for refusal to give an invoice certificate. Any person aggrieved, or local authority authorized by the Ministry, subject to the above provisions, may institute prosecutions, but these must not be instituted later than three months after the invoice was received and unless the regulations have been complied with. Proceedings may be taken either in the place where the sample was purchased or where the purchaser resides. Any person aggrieved by summary conviction may appeal to the higher Court. The Act applies to both wholesale and retail sales. The word "soluble" is defined as meaning soluble in water, and "insoluble" as insoluble in water, and provision is made for the inclusion of citric acid as a solvent recognized by the Act. Power is given the Ministry to make regulations for carrying out the provisions of this Act.

THE LAW OF VICTORIA.

The Acts of the Dominions are more stringent than those of the Mother-country, and impose more conditions on the vendor of fertilizers. Under the provisions of the Fertilizers Act, 1915, of Victoria, every parcel of fertilizer must be labelled with the maker's name and address, brand, weight, and composition of the contents, and in the case of some fertilizers, such as bonedust and basic slag, the fineness must be stated. No fertilizer is to be sold except in parcels. In addition to the invoice certificate, which must be given to the purchaser, the labels are deemed to be a warranty. In taking samples for analysis glass bottles are specified to be used, and 10 per cent. of the packages of any lot of fertilizer must be sampled. The analyst must state in his report that he has followed any method which has been prescribed.

In this Act provision is made for the Chemist of the Department of Agriculture or his deputy to inspect any fertilizer premises and take samples for analysis, but in this case if there is a deficiency found the analysis must be repeated on a separate portion of the sample by a second analyst to be nominated by the Minister before proceedings may be taken against the vendor.

A register of fertilizer brands is to be kept by the Director of the Department of Agriculture, whose approval is necessary before any brand can be registered, and who can alter or amend the register to accord with the facts. The register is to be open to the public, and the registration is to take place annually on or before 1st November. Fees are charged for registration, and every manufacturer or importer in his sworn declaration applying for registration must state the raw materials from which the fertilizer is manufactured or prepared, and the retail price as well as the chemical composition and other particulars concerning the brands to be sold by him during the year. New brands are not to be registered in other than the specified time in each year without the express sanction of the Minister. From the data registered the Chemist of the Department is charged with the duty of compiling a list of the fertilizers, and the prices and the average unit values of the fertilizer constituents, to be published in the Government *Gazette* as soon as practicable after 1st December of each year. (In South Africa the matter is to be published before 1st March, and in other States publication is permissive.) The average unit values are to continue in force for the year, and constitute the basis for calculating the values of all the fertilizers during the period.

Persons or associations of persons may import fertilizers for their own use (but not for sale again) without fully complying with the Act. In such a case a sample of the fertilizer must be sent free of charge to the Chemist of the Department with full particulars and a fee. All parcels of fertilizers imported under this clause must when distributed be labelled with the full particulars as supplied to the Chemist.

The Chemist must publish a list of samples analysed and brands registered from time to time in the *Gazette*, and must report the analysis of any sample within thirty days of receiving it. The publication may subsequently be repeated in any newspaper, and the Act exempts the owner, printer, or publisher from liability in connection therewith. The Chemist, his deputy, or any policeman has power to demand from any purchaser of any fertilizer the name and address of the vendor, the price charged or paid, and the production of the invoice certificate for inspection. A penalty is prescribed for refusing to give such information or obstructing the officer. Provision is made that where any offence under the Act is committed by some person without the knowledge, consent, or connivance of the vendor the actual offender shall be held responsible and may be brought before the Court. Provision is made whereby a vendor who relies on the warranty given by a prior vendor may recover from the latter the cost of any action he may have sustained if such warranty has proved false. The prior vendor is entitled to prove that any conviction recorded against the vendor was wrongful. Any purchaser of any fertilizer is entitled on payment of the prescribed fee to have such sample analysed by an analyst under the Act and to receive a certificate of such analysis. The Act is not to lessen the right to any civil remedy which any party

aggrieved may possess, and he may also institute proceedings under the Act. Any vendor may be required by the Minister to forward to the Chemist a sample not exceeding 2 lb. in weight of any fertilizer registered. Forgery of certificates under this Act is punishable by five years' imprisonment with hard labour. The Chemist, his deputy, or any police officer acting under the direction of the Minister may take proceedings for the recovery of any penalty under the Act.

In some fertilizer laws, but not in that of the United Kingdom, there is a provision exempting from the application of the Act sales of small quantities of fertilizers, such as those made to gardeners by seedsmen. In the Victorian Act the limit is ½ cwt., a sale of this quantity or more coming under the law; in South Africa it is 100 lb., in West Australia ½ cwt., in New Zealand 5 cwt., and in Tasmania 1 cwt.

THE LAW OF QUEENSLAND, SOUTH AUSTRALIA, WESTERN AUSTRALIA, CANADA, AND SOUTH AFRICA.

The Fertilizers Act, 1914, and the amending Act of 1916, of Queensland, in addition to other provisions—many of them similar to those of the Victorian Act—make it compulsory for every vendor of fertilizers to obtain a license to sell, which must be renewed annually. This provision also occurs in the South Australian and Canadian laws. Any person selling fertilizers without a license is liable to have the fertilizer seized, forfeited, and disposed of as the Minister may direct. Every vendor must produce his license when required to do so by any purchaser or officer, and if convicted of any offence under the Act twice within twelve months may have his license cancelled by the Minister. The composition of any brand of fertilizer may be amended by the vendor giving one week's notice to the registration officer. In the body of the Act the limits of deficiency allowed are stated, and it is an offence to exceed these. It is no defence that a fertilizer, though deficient in one or more constituents, was not deficient in others. The buyer of any fertilizer may on payment claim an official analysis, and in event of a deficiency may recover the cost of analysis or claim to have it added to any penalty imposed on the vendor.

The South Australia Fertilizers Act, 1918, prescribes provisions similar to those of the Victorian Act, enabling the Department of Agriculture to license vendors and register brands, and lays down similar duties of vendors in regard to the issue of invoice certificates, labelling of packages, &c. A novel feature of this Act is the provision that the purchaser is not bound to accept delivery of a fertilizer unless the conditions regarding the delivery of invoice certificate and labelling of bags have been complied with. The fact that a fertilizer was in registered premises is held to be conclusive evidence that it was for sale. In this Act a buyer may have a sample taken if this is done within two months of delivery. A good defence is to prove that the storage of the fertilizers was insufficient to enable it to be kept perfectly dry. Power is given to the Governor to fix standards for fertilizers.

The West Australia Fertilizers and Feeding-stuffs Act, 1904, contains provisions similar to those of other Australian States in regard to registering and affixing brands, giving invoice certificates, and procedure to be observed in taking samples for analysis.

The Canada Fertilizers Act, 1909, and the amending Act of 1919, in addition to provisions relating to the registration of brands, the annual licensing of vendors, and the making of analyses for purchasers, prescribe that a registration number is to be used with every brand of fertilizer, which number is to be cancelled if the fertilizer is altered in composition. In addition to the usual information to be given to the purchaser the vendor must state the materials from which the fertilizer is made. The Act specifies that where leather in any form, wool-waste, hair, or any inert organic nitrogenous material forms part of a fertilizer the percentage of such ingredient must be mentioned in the guaranteed analysis, unless by processing the nitrogen has been made available in such materials.

South Africa has an Act (No. 21 of 1917) regulating the sale of fertilizers, seeds, farm foods, and pest remedies. It provides that no person shall sell as a fertilizer any article which does not contain, in a form or combination available as plant-food, nitrogen, phosphoric acid, potash, or lime. Bones may not be imported, and fertilizers made from bones must be sterilized to the satisfaction of the Minister. Most of the provisions which appear in the legislation of other countries may be incorporated in this Act by means of regulations, there being power to make regulations for the labelling of sacks, &c., the registration of fertilizers, the issue of invoice certificates, the limits of deficiency, the analysis of fertilizers, methods of taking samples, &c. Imported fertilizer may be detained at any port for examination. Government officers taking samples for analysis must pay a reasonable rate for them unless the vendor refuses to accept payment. A credible witness must be present at the taking of such samples.

In Canada, South Africa, Queensland, South Australia, and Tasmania the annual registration of all brands of fertilizers is necessary. The labelling of packages with the particulars of the contents is also insisted on by the laws of Queensland, South Australia, West Australia, Canada, and South Africa.

(To be continued.)

Fixing Labels on Fruit-cases.—Trouble is often experienced by fruitgrowers through the display-labels peeling off fruit-cases in sun or damp, owing to defective paste or pasting. The following recipe and directions have given satisfactory results: Take 8 lb. flour and 2 oz. powdered alum mixed together to a thick paste with a little cold water. Add boiling water to the paste thus formed, constantly stirring all the time until the quantity totals about 4 gallons. The chief essentials are the *boiling* water and the *constant stirring* while this is being added. If found too thick after cooling, small quantities can be further diluted by addition of a little more water. Apply paste to end of case, then place label, pressing it on firmly with a dry wide brush. If the label is damped with water beforehand and applied in this condition, it is found to adhere tighter. This, of course, makes considerably more work, and it is doubtful if the extra trouble is justified.—*Horticulture Division.*

AN ECONOMIC INVESTIGATION OF THE MONTANE TUSSOCK-GRASSLAND OF NEW ZEALAND.

XI. THE GRASSLAND OF THE HUMBOLDT MOUNTAINS ESTABLISHED SINCE THE BURNING OF THEIR FOREST COVERING.

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GENERAL.

THE Humboldt Mountains are a lofty range, more than 8,000 ft. high, which abut on the shore of Lake Wakatipu from near the mouth of the River Greenstone to Kinloch, at the head of the lake, thence extending on the western side of the Dart Valley to the River Routeburn. That portion of these mountains with which this article is concerned is the extremely steep face, originally densely clothed with southern-beech (*Nothofagus*) forest, lying between Kinloch and the Greenstone.

During the first week of January, 1887, a destructive fire swept over that part of the forest under consideration; nevertheless the destruction was not complete, for large patches of green or scorched trees were left standing. On 14th February, 1895, a second fire occurred, which broke out at about one mile north of the Greenstone and extended over all the former burnt area, reaching finally to within about half a mile of Glacier Creek. According to Mr. T. E. Bryant, who has kindly supplied me with first-hand information concerning both fires, all the patches of trees already mentioned, except a narrow belt along the shore of the lake, were destroyed, together with some hundreds of acres of forest which had escaped the first conflagration. Thus, almost from the margin of the lake, the mountain-slope, devoid of plant-life, up to the irregular lower margin of the subalpine forest, stood ready for a new plant-covering. Moreover, the seed-bed its surface offered was quite equal to that provided by the usual method of first felling and later on burning the timber lying on the ground.

At the present time several distinct types of vegetation are either firmly established or in process of establishment—namely, grassland, fernland, regenerating forest of two kinds, and a remarkable association with a mat-forming, moss-like species of raoulia (*Raoulia glabra*) as its principal constituent. Here the regeneration of forest will not be dealt with, but will form the subject of a special article distinct from this series.

In the Otago lakes country there are considerable areas of southern-beech forest many of which are in danger of being accidentally set on fire during a dry season, while other portions, as settlement becomes closer, may be purposely burnt for replacement by pasture. Thus the lesson to be learnt from what has taken place on the Humboldt Mountains should have considerable economic bearing.

My personal knowledge of the area under consideration dates from about a year after the first fire when, in making an ascent of Mountain Bonpland—the highest peak of the range—the burnt slope was traversed. Two years after the second fire I again visited the locality, ascending on two occasions by different routes to high above the forest-line. In May, 1921, rather more than twenty-four years after this second visit, in company with my assistant, Mr. W. D. Reid, I again visited the burnt area, and, for the purposes of this article, we traversed the slopes in four different directions, in one part passing through the subalpine forest to a short distance above its upper limit at 4,000 ft. altitude.

CONDITIONS FOR THE ESTABLISHMENT OF THE NEW PLANT-COVERING.

As explained in article I of this series, there occurs throughout the South Island a critical line some few miles to the east of the actual divide, denoting the average limit reached by the frequent north-westerly downpour, and always to be clearly distinguished by the abrupt termination of the western forest and the sudden appearance of eastern tussock-grassland. The Humboldt Mountains facing Lake Wakatipu are clearly on this critical line, and, originally forest-clad up to 4,000 ft. altitude, stood out distinct from the drier tussock-clad slopes of the Richardson Mountains on the east.

Judging from the average 30 in. of rain at Queenstown, situated as it is very near the arid area of Central Otago, the average yearly rainfall of the Humboldt Mountains must be at least 60 in.; but probably this estimate is far too low. The rainfall, then, is suitable not only for forest, but for rich grassland composed not of more or less unpalatable tussocks but of European grasses. Near the lake itself frost can never be severe, since the blue-gum (*Eucalyptus globulus*) is quite at home. Also, it seems reasonable to conclude from a study of the vegetation that even up to a height of 3,000 ft. there is comparatively little frost of moment.

The soil consists of a clay derived partly from the underlying rock (greywacke) and partly from glacial deposits. Judging both from the original plant-covering and from that of the present time it is of considerable fertility. Excepting close to the standing forest at the base of the mountains, at above 3,000 ft. altitude, and near the northern limit of the fire, the abundant surface humus of the forest-floor was destroyed.

Although the slope as a whole faces eastward, its many irregularities lead to other aspects and to considerable differences in the water content of the soil. Fallen burnt trunks are still a frequent feature. The steepness of the slope generally favours excellent drainage, which is assisted by the numerous deep gullies; nevertheless there are many hollows and other places which are more or less permanently wet.

The conditions for revegetating the ground were not merely those due to climate and soil, nor were the new plant-associations to be derived only from seeds brought by chance from plants in the immediate vicinity, or at a distance. Several factors came in which, although they made the condition of affairs more complex, have also made the problem more interesting from the economic standpoint.

Foremost comes the fact that from the south side of Kinloch Creek to some distance past Sawmill Creek, and up to a height of at least 1,500 ft. but probably higher, the Otago branch of the Lands Department about the end of September, 1895 (*i.e.*, some seven months after the second fire), carried out an extensive sowing. According to information kindly sent me by Mr. R. Sadd, Commissioner of Crown Lands, Dunedin, the following seeds were forwarded to Mr. G. Mackenzie, of Queenstown, for sowing on the area: Cocksfoot, 2,500 lb.; alsike, 500 lb.; rye-grass, 62 bushels; white clover, 500 lb.; and Chewings fescue, 500 lb. The amount of each of these sown per acre was: Cocksfoot, 10 lb.; rye-grass, 5 lb.; white clover, 2 lb.; alsike, 2 lb.; Chewings fescue, 2 lb. In a subsequent letter to the Lands Department, dated 10th July, 1897, it was reported that the sowing had been very successful, and a further sum of £25 was asked for in order to sow an additional area; so there were despatched for that purpose—Cocksfoot, 730 lb.; white clover, 100 lb.; and Chewings fescue, 168 lb. Further, £2 5s. was spent on blue-gum seeds for sowing on the burnt areas.

On the other hand, no sowing has taken place on the areas north of Kinloch Creek, south of the southern limit of the sowing, and everywhere above the uppermost limit of the sowing up to the present subalpine forest. There is, then, the effect of sowing and non-sowing to be considered. Further, the sown area is separated into two parts by a fence, on the north side of which there has for some time been heavy stocking with sheep; while on the south side, up to the boundary-fence of the Birchdale Run, there has been of recent years extremely light grazing by cattle and horses; in short, one part has been stocked to its utmost capacity, and the other part in many places hardly stocked at all. Regarding that important matter, the treatment of the new grassland at an early stage, I know nothing. In addition, there is to be considered the unsown ground north of Kinloch Creek, now grazed heavily by sheep, which is separated from the equally heavily grazed sown area by a deep gully. Besides seeds purposely sown, or conveyed by winds or birds, or which might fall to the ground from unburnt plants in the gullies or standing forest, many would be brought by the stock, which would also trample the seeds into the ground.

Unfortunately, when visiting the area in 1897 I did not take any notes regarding the new vegetation, but, according to my recollection, Scotch thistles (*Cnicus lanceolatus*) and several species of indigenous willow herbs (*Epilobia*) were abundant. Such would be merely an early stage of succession, which has left no mark. Thus the present grassland and fernland, about to be described, are the outcome of changes which have taken place since the second fire twenty-six years ago, but nothing can be said here regarding the actual evolution of these two communities.

THE PRESENT VEGETATION.

As may well be expected in an area exposed to such different conditions for occupation by plants, there is no uniformity in the present plant-covering. It cannot, then, be described as a whole, so it is here dealt with under the following heads: (1) The sown area; (2) the unsown area to the north of Kinloch Creek; (3) the upper unsown area. There is also a fourth area adjacent to the unburnt forest, but this does not concern this article.

(1.) *The Sown Area.*

At the present time that portion of the steep mountain-face which was sown in 1895 is occupied by three distinct and antagonistic plant-communities—grassland, fernland, and regenerating forest so far consisting principally of tree-fuchsia (*Fuchsia excorticata*). Grassland and fernland are each dominant over wide areas, but generally the fern is slowly but surely invading the former, creeping up from its special habitat, the gullies (see Fig. 1), so that there is every stage of transition from the one to the other, while wide areas of grassland must have been already replaced by fern. However, there is much evidence to show that such aggressiveness of the fernland would even yet not only be lessened, but gradually overcome, by frequent burning and much heavier stocking by cattle. Generally the distribution of grassland and fernland is regulated by aspect, the former occupying the drier and sunnier faces, where, even under the present conditions, it must have held its own for a good many years.

The grassland now consists of a different combination of species to that contemplated when the original grass-mixture was sown. There is no longer either rye-grass (*Lolium perenne*) or alsike (*Trifolium hybridum*), while cocksfoot is only present under special circumstances. Also, certain grasses and other pasture-plants, some of great value, have come into the pasture of their own accord. The following is a list of the species making up the present grassland: Palatable species—Catsear (*Hypochoeris radicata*), Chewings fescue (*Festuca rubra* var.), cocksfoot (*Dactylis glomerata*), the indigenous Otago triodia (*Triodia Thomsoni*), the indigenous tufted danthonia (*Danthonia semiannularis* var.), Yorkshire fog (*Holcus lanatus*), white clover (*Trifolium repens*), and (but much less common) fiorin (*Agrostis alba*) and the indigenous dwarf poa (*Poa pusilla*). Unpalatable species—the slender everlasting (*Helichrysum filicaule*), the slender New Zealand daisy (*Lagenophora pumila*), and marsh-pennywort (*Hydrocotyle novae-zelandiae*), all three being indigenous plants. These unpalatable plants, which may be designated "grassland weeds," for the first few hundred feet do not greatly affect the quality of the pasture, but with increase of altitude they gradually become more abundant, and their ranks are swollen by the addition of other pasture-weeds, especially green raoulia (*Raoulia glabra*), mountain-piripiri (*Acaena Sanguisorbae* var. *pilosa*), and certain other species mentioned under another head.

The composition of the grassland is clearly regulated by the amount of water in the soil, so that excess of moisture, or excess of dryness, each supports a distinct kind of pasture, while in intermediate stations the two associations merge one into the other.

In those dry situations which occupy the greater part of the ground there is a more or less close turf (see Fig. 2), made up of tufted danthonia or Chewings fescue, one or the other being usually dominant, together with a good deal of catsear, more or less Yorkshire fog, and, in places, some Otago triodia. The amount of catsear—a plant of high palatability—varies greatly, but in many places it has become the principal species. Where grazing has not taken place for some considerable time there is abundance of cocksfoot (see Fig. 3 on left), but this grass, unfortunately so easily eradicated in the montane grassland by continuous or excessive grazing, is generally wanting, or growing only close up to the fallen tree-trunks where it is protected.

FIG. 1. VIEW OF PORTION OF THE SOWN AREA ON THE HUMBOLDT MOUNTAINS.

On the right, fern creeping out of the gully and invading the grassland in the centre and to the left.

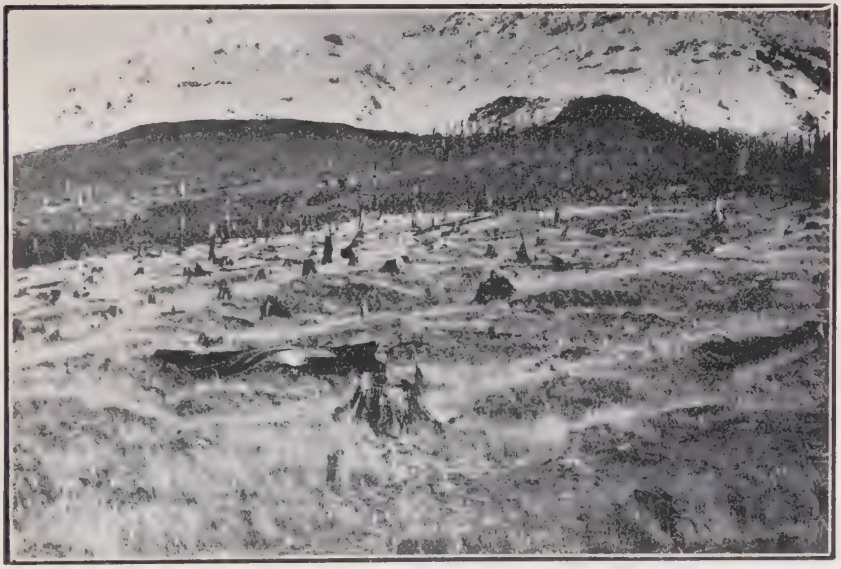

FIG. 2. GENERAL VIEW OF AN EXTENSIVE PIECE OF THE SOWN GRASSLAND, SHOWING THE GROUND COMPLETELY COVERED.

[*W. D. Reid, photos.*

In damp places another kind of pasture is to be found, consisting of catsear, cocksfoot, Yorkshire fog, and white clover, together with only a limited quantity of Chewings fescue and tufted danthonia. Fog, too, almost pure, frequently occupies such moist places as occur on the drier slopes.

The grassland as here described constitutes a pasture of far higher palatability and carrying-capacity than does the best tussock-grassland. But had a different seed-mixture been originally sown, containing, for instance, meadow-grass (*Poa pratensis*), fiorin (*Agrostis alba*), and crested dogstail (*Cynosurus cristatus*), the pasture-value would have been much higher. All the same, where there is danger of invasion by fernland, Chewings fescue and danthonia (which here came in unbidden) are of particular value, while the much more palatable catsear also thrives and rapidly increases in the presence of fern.

Finally, with regard to the grassland it is rather remarkable that none of the tussock-grasses has become established. This is a matter of extreme importance, since one enemy to high-class pasture can be ruled out of court. In a drier climate, after the burning of southern-beech forest, tussock-grassland would readily have become established, and as time went on it would have been indistinguishable from the ordinary tussock-grassland in its vicinity.

The fernland consists chiefly of bracken-fern (*Pteridium esculentum*). It varies in composition, from that where fern grows so thick as to exclude or choke out other plants to that which is quite open and contains various grasses and herbs in such quantity that there is a good deal of feed. Catsear, white clover, and Chewings fescue are most important constituents of open fernland. Where cattle graze frequently they make tracks through the fern, which soon become occupied by pasture-plants. These, in their turn, attract stock, and thus the fern may be suppressed and pasture established. Tutu (*Coriaria sarmentosa*) is also a common, but unwelcome, constituent of fernland, and is plentiful in parts of the area. Even where fern is absent *tutu* forms close patches in many places, which may rapidly spread at the expense of the grassland. Still more unwelcome is the tutsan (*Hypericum Androsaemum*), an introduced weed with great power of spreading where the rainfall is abundant. At the present time, though almost altogether confined to the fern in the southern portion of the area, there is a little also on the unsown ground at about 2,000 ft. altitude.

(2.) *The Unsown Area North of Kinloch Creek*

This area extends from the deep gorge of the creek up to the present standing forest, where the fire gave out. Generally the destruction of the vegetation and the humus was not so complete as on the remainder of the mountain-slopes, so the conditions were more favourable for forest-regeneration and more hostile to the permanent establishment of grassland; and this was accentuated through the non-sowing of the ground. All the same, thanks to the wet climate, aided largely by the presence of stock and their trampling, and to the natural agencies for the dispersal of seeds, there is established over a good deal of the lower portion of the area grassland pretty nearly equal in quality to that of the sown area.

FIG. 3. FENCE AT 1,500 FT. ALTITUDE SEPARATING THE HEAVILY GRAZED (ON RIGHT) FROM THE LIGHTLY GRAZED AREA (ON LEFT), WHERE A TALL GROWTH OF COCKSFOOT CAN BE SEEN.

FIG. 4. VIEW OF THE MASS OF TREE-FUCHSIA WHICH, TO THE NORTH OF KINLOCH CREEK, HAS BECOME ESTABLISHED SINCE 1895.

[*W. D. Reid, photos.*

On the upper part of the slope the state of affairs is quite different, for, as shown in Fig. 4, tree-fuchsia has apparently taken almost complete possession of the ground. But even here between the bushes there is good grass, while grass-covered open spaces of considerable size are not wanting.

The grassland consists principally of a dense turf of Yorkshire fog closely cropped by sheep. In places there is a good deal of tufted danthonia, and, throughout, more or less catsear. The most important weed, which considerably reduces the pasture-value, is the marsh-pennywort (*Hydrocotyle novae-zelandiae*), a lowly creeping herb with small round leaves. In places this plant is abundant, and it spreads rapidly by means of its far-extending, creeping stems. An examination of the relation of fog to pennywort seemed to indicate that the former is able to hold its own, for in many places seedling plants of the grass had invaded the pennywort mats. Certainly, where the ground is wettest the pennywort is unable to compete with the grass. On the driest ground the slender everlasting and the spineless piripiri (*Acaena inermis*) are also bad grassland weeds. Where the ground is particularly damp the fog was more closely eaten than when growing on the drier ground (see Fig. 5).

At the base of the slope there is a belt of fernland, but higher up fern is apparently of little moment, though on the other side of Kinloch Creek it is abundant.

(3.) *The Upper Unsown Area.*

This is that portion of the slope, in places exceedingly steep, extending from about the 1,800 ft. line to the lower margin of the subalpine forest. So far as rainfall and soil go the conditions for vegetation are much the same as below, but the area is subject to more snow and more continuous though not really severe frost, and, with regard to its revegetation, species from the upper parts of the mountains easily gain a footing. Also, owing to the ground not being sown, stock would not visit the area, so their seed-sowing influence would not come into play. An interesting lesson, then, is to be learnt as to what is likely to happen at from 2,000 ft. to 3,000 ft. altitude on a steep western Otago mountain, facing east, after the primitive southern-beech forest is completely destroyed by fire.

Seen from a distance, the new plant-covering gives a uniform brownish tint to the hillside. A closer view shows that this arises from the extreme abundance of the green raoulia (*Raoulia glabra*), which, in its green, soft, moss-like mats, or low hummocks, indicates the high rainfall of the Humboldts, just as the hard, silvery cushions of its relative the scabweed (*Raoulia lutescens*) plainly denote the arid climate of Central Otago.

The hummocky mats of the raoulia, several feet in diameter, growing one into the other, make a more or less continuous carpet on the ground (see Fig. 6) into which the foot sinks. Apparently this raoulia carpet is an excellent seed-bed, for growing on it are a good many species, some having ascended from the lower slopes and others having descended from the virgin plant-associations above the forest-line. The following are common representatives of the lower grassland: Catsear, Chewings fescue, tufted danthonia, Yorkshire fog, and white clover.

FIG. 5. YORKSHIRE FOG GROWING IN DAMP GROUND CLOSELY CROPPED BY SHEEP, WHILE BEHIND IT IS HARDLY EATEN AT ALL.

Unsown area, north of Kinloch Creek.

FIG. 6. VIEW OF PIECE OF THE GREEN RAOULIA ASSOCIATION AT NEARLY 1,800 FT. ALTITUDE.

Showing the raoulia hummocks making a thick continuous carpet, and tufted danthonia and Yorkshire fog growing on them.

[*W. D. Reid, photos.*

The mountain-plants form the greater part of the vegetation, but are nearly all "weeds" from the pasture standpoint. Apart from the easily dominant green raoulia, the most abundant is the mountain club-moss (*Lycopodium fastigiatum*), a semi-woody unpalatable plant of great spreading-power, more or less green in summer, but in autumn and winter of a brilliant orange colour. Tussock-grasses, absent in the lower pasture, are represented by a good many patches or plants of the alpine danthonia (*Danthonia setifolia**), an unpalatable grass, its small tussocks about 8 in. high, poa-tussock (*Poa caespitosa*), and tall blue-tussock (*Poa intermedia*). There are many young bushes of the mountain-tauhinu (*Cassinia Vauvilliersii*), which, occasionally, are making thickets. In some places the silvery piripiri (*Acaena Sanguisorbae* var. *sericeinitens*) is fairly common, and the two ferns, alpine hard-fern (*Blechnum penna marina*) and the thousand-leaves (*Hypolepis millefolium*) form considerable patches. Rarer than any of the foregoing, but likely to increase in numbers, are the creeping koromiko (*Veronica Lyallii*), the mountain-box (*Veronica buxifolia*), and the silvery cotton-plant (*Celmisia coriacea*).

Judging from the number of young plants settling on the raoulia hummocks, it seems clear that the raoulia association is merely a stage in the development of another association the composition of which can as yet only be a matter of speculation. Probably the turf-making grasses will greatly increase, and so too, but more slowly, the tussock-grasses; the mountain-tauhinu will form thickets in which would be included the mountain-box; the piripiri might increase; and the silvery cotton-plant may be expected to form large patches. Then, if the turf-making grasses can increase with sufficient rapidity, it is possible that the incoming of the high-mountain plants would be checked and that grassland would be the final association. Had sowing of grasses been carried out soon after the fire, undoubtedly there would now have been very little raoulia and its accompanying pasture-weeds. Thus it seems safe to conclude that in Western Otago southern-beech forest can be felled and burnt up to an altitude of 3,000 ft., and, with care—*i.e.*, with proper sowing and judicious stocking—be replaced by good grassland.

SUMMARY.

(1.) The article gives an account of the new grassland and some other associations which have occupied the eastern slopes of the Humboldt Mountains, facing Lake Wakatipu, up to the commencement of the subalpine forest, since the final destruction of the original southern-beech forest in 1895.

(2.) One portion of the area was sown with various grasses and the the remainder was left unsown. Of the species sown there is no longer either rye-grass or alsike.

(3.) The sown portion of the ground is now covered in part, especially on the drier ground, with good pasture composed chiefly of tufted danthonia, Chewings fescue, Yorkshire fog, catsear, and Otago triodia. There is also some white clover and cocksfoot. The two latter and

* *Danthonia setifolia* (Hook. f.) Cockayne new species = *D. semiannularis* R. Br. var. *setifolia* Hook. f. in "Manual of the New Zealand Flora" (1906), p. 891, where it is clearly described. The plant occurs unchanged throughout most mountainous New Zealand, and can be recognized at a glance from any form of *D. semiannularis*.

Chewings fescue were in the original mixture, but the other species have come spontaneously.

(4.) The remainder of the sown area is occupied by fernland, which is gradually encroaching on the pasture, but, where open, it contains a fair amount of feed.

(5.) It seems highly probable that were the fern periodically burnt and the ground heavily stocked with cattle it could be suppressed.

(6.) A rather narrow area to the north of Kinloch Creek was not sown. There, on the lower part, grassland consisting chiefly of Yorkshire fog, but with some tufted danthonia, has become established; at a higher altitude there is tree-fuchsia in great abundance.

(7.) No tussock-grasses have become established, as might have been expected, on either the sown or the unsown grassland up to an altitude of about 1,700 ft.

(8.) Grassland weeds at first are few in number, but with increase in altitude they also increase.

(9.) Where heavily grazed, cocksfoot is only present in places sheltered by logs lying on the ground, but where no grazing has taken place this grass is in abundance.

(10.) The unsown ground at above some 1,700 ft. altitude is now closely covered with low hummocks of green raoulia growing into one another and forming a thick continuous carpet, which is proving an excellent seed-bed both for good pasture-plants coming from below and for grassland weeds descending from the subalpine plant-associations above.

(11.) The raoulia association is merely a temporary community in process of change. Possibly the ultimate vegetation will be either grassland or a mixture of such with shrubland and colonies of subalpine plants.

(12.) From the evidence supplied by the investigation on which this article is based it is considered that southern-beech forest in Western Otago can be felled, burnt, and successfully replaced by good grassland if a proper seed-mixture be sown and attention paid to correct stocking.

Wool-growing.—In the course of a paper read at the recent conference of the Council of Agriculture, Mr. W. Perry, the well-known Wairarapa sheep-breeder, gave the following opinion: "Breeders of the heavier wools would be, I think, very unwise to go rushing into fine wool now, for by the time they had developed a fine-woolled flock the fashions would probably be changed, and they would be out of it again. It is better to breed a class of wool that will have a good average demand over a number of years, and, provided it is suited to the land and climate with which one is working, to stick to it right through. A prominent wool buyer recently informed me that the counts of wool which met with the most ready sale over an average of years were from 44's to 48's, provided they were of first-class quality."

ASHBURTON EXPERIMENTAL FARM.

NOTES ON OPERATIONS, SEASON 1920–21.

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THE following notes afford some account of the principal operations at the Ashburton Experimental Farm during last season. The weather experienced during a large part of the season was by no means favourable. November, December, and the early part of January were a dry period; a break then occurred; and dry conditions again prevailed from February onward. The grass-grub was also prevalent, materially interfering with certain experiments.

For the information of those readers not acquainted with the locality it may be mentioned that the farm consists of 134 acres situated on the outskirts of Ashburton, in middle Canterbury. The property, which is an endowment of the Ashburton High School, has been operated by the Department of Agriculture for some years past for the purpose of carrying out experimental work of district usefulness and interest. The farm also serves to give the boys of the High School agricultural class an insight into practical farming operations. It should also be stated that owing to the uneven nature of the soil on the farm area—extensive patches of shingle being interspersed with areas of deep rich loam—close experimental work is rendered difficult in many instances.

RAPE AND PASTURE ESTABLISHMENT.

A very common practice in Canterbury is to sow rape in 14 in. drills along with a rye-grass-red-clover mixture. This generally accepted method, which as a rule gives rise to a thin temporary pasture, was tried out against intercultivated spring-sown rape followed by autumn-sown grass of the same mixture. Following are the particulars:—

Plot A, Spring-sown Rape and Autumn-sown Grass.—This plot, consisting of 5 acres, was sown with rape in 14 in. drills on 13th November, 1920, at the rate of 2 lb. per acre, with 1 cwt. of superphosphate per acre. This being the dirtiest portion of the field, the rape was sown in rows wide enough to allow room for intertillage. A heavy hailstorm and dry windy weather experienced shortly after sowing made the ground hard and crusty, and the germination was slow and patchy. The grass-grub beetle then attacked the plants, doing so much damage that the plot had to be resown on 10th December, a further amount of ½ cwt. super per acre being also applied. The braird was good despite dry weather. The plants came away well, and were horse-hoed and hand-hoed early in January.

The plot was grazed with an average of 178 lambs from 16th March to 6th April. They had a run-off on to an old cocksfoot and rye-grass pasture of about 3½ acres, but made very little use of this, camping mostly on the rape. When the lambs were put on the rape

was showing signs of aphis attack, especially on the lighter land where it had wilted down. They evidently preferred this badly blighted wilted stuff to the fresher rape, and it was eaten well down before the fresher rape was eaten to any extent. The green weight of the rape crops, taken on 17th March, was 16¼ tons per acre.

As soon as the lambs were taken off plot A the rape stubble was ploughed and worked with disk harrows, harrowed, rolled, and sown down on 15th April with a mixture of 24 lb. Italian rye-grass and 6 lb. cow-grass per acre. This mixture has brairded well, and it remains to be seen how it will stand. At time of writing (August) the plot is looking exceedingly well.

Plot B, Rape and Grass, Spring-sown.—This plot (5 acres) was sown down on 15th November with rape at 3 lb. per acre in 14 in. drills, and broadcast with 24 lb. Italian rye-grass and 6 lb. cow-grass per acre, the manuring being 1 cwt. super per acre. There was a good strike of both rape and grass. On this plot the rape survived the attacks of the beetle, and although the weather continued dry it did well. The grass died off in a good many places before the rape was ready for feeding.

On 3rd February twenty store lambs (after being fasted for seven hours) were weighed and put on the plot. The average weight per head when put on was 64·05 lb., and when taken off on 23rd February 74·45 lb., the average gain being thus 10·4 lb. The plot carried a total of 135 lambs between the dates stated. The lambs ate the grass and clover down to the roots before touching the rape, and as the weather continued unusually dry (even for Canterbury) the grass and clover have practically died out. This method of grassing down is often very successful when weather conditions are favourable, but when the rainfall is light failures are frequent. The sheep consolidate the top soil, and the escape of moisture in dry north-westerly weather is rapid. A good pasture can sometimes be established by sowing down with soft turnips about Christmas, but this, of course, means losing the larger part of the turnips, as the butts cannot be grubbed up without damaging the grass.

In comparing the weights of green matter produced and carrying-capacity of the two plots it should be mentioned that the quality of the land in plot A is rather better than that of plot B. Also the former received extra cultivation and manure at the time of reseeding. At the same time I am quite of opinion that the intertillage and hoeing given during the dry summer had much to do with promoting growth and conserving moisture, as the rape on plot A grew steadily on without apparent check, and by March the rows could not be distinguished, some of the plants at this stage being 3 ft. high. Despite the loss of time occasioned by the resowing of plot A the yield of green matter was 5 tons per acre heavier than that of the non-cultivated plot B.

FODDERS.

The area devoted to fodder-crop trials was divided into four plots of 4·80 acres each. The previous crop had been wheat. The land was autumn-ploughed, worked up in spring with the grubber (three strokes), and given one stroke of the tine harrows. The plots were

rolled previous to sowing, except No. 1. Sowings were carried out between 18th and 24th November, as follows: Plot 1, partridge peas, drilled 2 bushels per acre, with 1 cwt. super; plot 2, Thousand-headed kale, drilled in 14 in. rows, 3 lb. per acre, with 1 cwt. super; plot 3, kohlrabi (green), drilled in 14 in. rows, 10 oz. per acre, with 1 cwt. super; plot 4, kohlrabi (purple), drilled in 27 in. rows, 10 oz. per acre, with 1 cwt. super.

Plots 2, 3, and 4 failed owing to dry weather and beetle attacks. As it was too late in the season to resow with kohlrabi, plot 3, which was the first plot to fail, was resown with Imperial Green Globe turnip; plot 2 was again sown with Thousand-headed kale; and plot 4 was resown with Fosterton Hybrid turnip. Further details are given later.

Plot 1, Partridge Peas.—The green weight, when taken on 20th February, was 8·40 tons per acre. The peas were fed off when well podded, but green and partly in bloom. They made fair growth considering the dry weather. A feeding-test with lambs was carried out on this plot, twenty white-faced lambs similar to those used for the rape and grass feeding-test being used. These lambs had been running on stubble and young grass for a fortnight previous to being put on the peas, while the lambs used for the rape test were taken off their mothers and put straight on to the plot, stubble feed not being available at that time. The average weight per head when put on on 23rd February was 67·26 lb., and when taken off 71·45 lb., an average gain by 15th March of 4·19 lb.

Although this test was carried out three weeks later than that on the rape and grass, the days being a little shorter and the nights longer, the weather conditions for both tests were ideal. A stream of water runs through the pea plot, and a run-off on to old pasture was provided. The lambs wandered over the plot for two or three days before settling down to feed. The haulms were eaten a little at first, but it is evident that the peas were preferred. The lambs could be seen picking them off the ground even when ripe and hard. The plot carried 206 lambs for twenty days, with probably sufficient peas lying under haulms and in the dust to have carried the number for another week. It is estimated that about 30 per cent. of the peas were lost in this way, or at least were not available as feed.

The mob of 206 included lambs off the rape and grass previously reported on, a number of these being in very forward condition. It was expected that these forward lambs would have done well on the peas. They lost their bloom, however, and the wool appeared dry and sapless. When lifting a forward lamb over a fence on one occasion it was found that the wool could be pulled away from the skin quite easily, and several cases of the same kind were then noted. This was probably due to the lambs receiving a check through not taking readily to the peas during the first few days, as these cases were noticed eight or nine days after the sheep had been put on the plot. The wool had quite regained its hold of the skin when the lambs were taken off at the end of twenty days.

With anything even approaching the same fattening-powers as rape, peas have a good deal to recommend them as a fodder crop. They can be grown successfully under dry conditions, are immune from diseases

that affect rape, and are probably a safer lamb-feed under all conditions, it being well known that the death-rate on rape can be high if conditions are not favourable. The foregoing test is not altogether definite, as the rape lambs had the advantage of young grass with the rape. The lambs on the peas would undoubtedly have done much better with the addition of a young-grass pasture for a run-off.

After the lambs were taken off the plot was disked and rolled, and a first-class strike of broadcast peas has resulted. It is suggested that this plot of peas, or part of it, be allowed to make its full growth, thus providing some data regarding autumn-sown peas.

Plot 2, Thousand-headed Kale.—This plot was resown on 30th December at the rate of 3 lb. per acre, with ½ cwt. super per acre. The green weight taken on 13th March was 5½ tons per acre. About two-thirds of this plot is composed of light shingly land, and on these parts the kale was poor. Without a good rainfall late sowings of kale cannot be successfully undertaken on this class of land. It has been known to do remarkably well in this district on very light land if sown in the autumn. The plot carried 200 lambs from 14th to 25th April, and the second growth is light.

Plot 3, Imperial Green Globe Turnips.—The plot was resown on 14th December at the rate of 10 oz. per acre in 14 in. drills, with super at ½ cwt. per acre. The weight of the crop, taken in June, was 13¼ tons per acre. No after-cultivation was given. The soil on this plot is light, with shingly outcrops, and the crop was an average one for this class of soil.

Plot 4, Fosterton Hybrid Turnips.—The plot was intertilled and hand-hoed, and resown on 28th December at the rate of 12 oz. per acre, in 28 in. drills, with super at ½ cwt. per acre. The yield per acre, taken on 2nd June, was 12 tons. The land in this plot is similar to that of plot 3, but with a bigger percentage of good loam.

The approximate yields per acre of the two turnip plots have little value for comparative purposes on account of the different dates of sowing. It was quite evident, however, that the earlier-sown plot had made the better growth. Considering the quantity of fat-hen killed by intercultivation and hand-hoeing on plot 4, and the amount which seeded through lack of it on plot 3, there can be no doubt that the extra labour on plot 4 was justified.

A break taking in part of both varieties was fenced, and lambs put on at the end of May. They favoured the Green Globes first, but later the varieties were about equally favoured. A break of the two varieties was also fed off with wethers. Both varieties were affected a little with dry-rot, there being a greater percentage of unsound turnips among the Fosterton Hybrids than the Globes, the disease occurring mainly on the heavier land.

LUCERNE.

Rate of Seeding and Manurial Test.—A comprehensive experiment on a 20-acre field, divided into 1-acre plots, was set up to provide information on certain contentious points relating to lucerne-culture. Provision was made to compare various rates of seeding, 2½ lb., 5 lb., 8 lb., and 15 lb. of seed per acre being tried. The respective distances

apart of the drills were 7 in. (equivalent to broadcasting), 14 in., and 21 in., the two latter to allow of intercultivation. These plots were sown in duplicate, one area being unmanured, and the other manured with 2 cwt. super per acre. Areas have been also provided to allow of top-dressing with fertilizers, as well as areas for differential grazing-tests. A plot of cow-grass is receiving similar treatment to the intercultivated lucerne, in order that the merits of the respective crops may be compared over a period of three or four years.

The area selected for this trial has practically a uniform soil throughout, a good loam overlying shingle. The previous crop was wheat. The area was autumn-ploughed in 1920, and grubbed and harrowed at intervals from October until February to kill yarrow and sorrel. About 6 acres of the worst yarrow-infested part was cross-ploughed in December. One ton of ground burnt lime per acre was applied in December and January; further cultivation was given; inoculated soil, 3 cwt. per acre, was applied to one-half the area (across all plots), and the seed was sown in the first week of March after a good rain, the ground having been rolled previously. The strike was good on all plots, particularly in the 7 in. and 14 in. drills where superphosphate was used. In the 21 in. drill plots, with 2 cwt. super, the strike was slow and irregular, and the plants yellow in colour, and it looked as if the dressing of manure had been too heavy. These plots, however, have since made splendid growth, and have become the strongest in the test.

Although autumn-ploughed and worked through spring and summer, this land is by no means free from grass-grub, and there is evidence of their destructiveness in a good many places on the lucerne. Up to the present the manured plots are looking distinctly healthier than the unmanured ones, the top growth being longer and the roots more developed.

Seeding and Method of Sowing Test.—This refers to trials initiated in 1917, on an area of five plots of 0·7 acre each. The system of sowing was as follows: Plot 1, 7 in. drills, 8 lb. seed per acre; plot 2, 7 in. drills, 8 lb. seed and cross-drilled at same rate—total, 16 lb. seed; plot 3, 21 in. drills, 5⅓ lb. seed; plot 4, 14 in. drills, 8 lb. seed. The plots had lime and inoculated soil, and an application of super at time of sowing.

These plots were cut three times during the season. The first two cuts were good, but the third was hardly worth the labour of harvesting. The 14 in. and 21 in. rows were twice intercultivated during the season to an average depth of about 5 in., and were harrowed four times. It seems doubtful whether deep spring intercultivations without a fair rainfall are beneficial to the lucerne. It was noticed on one occasion this season, after a cultivation in which the grubber had been set to go deeper than in previous cultivations, that the lucerne immediately wilted. No doubt the fibrous roots stimulated and formed as a result of autumn cultivation were cut with the spring working, and in consequence the plants received a check and wilted. The lucerne was about 1 ft. high at the time and the weather very dry. Future cultivations in dry weather will be watched with interest.

The first cut of the season was made on 27th October. Approximate green weights of the second crop were taken on 29th December

with the following results per acre: Plot 1, 7½ tons; plot 2, 6½ tons; plot 3, 5¼ tons; plot 4, 5½ tons. Weighings of the third cut on 12th February were—Plot 1, 1¼ tons per acre; plot 2, 1 ton; plot 3, slightly under 1 ton; plot 4, 1¼ tons. On this class of land in Canterbury the spring cuts of lucerne are the heaviest of the year, and these results indicate the general condition—namely, a very marked falling-off in yield during the hot, dry months.

Lime and Inoculated-soil Test.—This trial was made with an area of one-year-old lucerne, divided into ten plots each of four rows 1 chain long, with two control rows between each plot. The scheme was as follows, all weights given being per acre: Plot 1, 1 ton burnt lime; plot 2, 1·8 ton carbonate of lime; plot 3, 2 tons burnt lime; plot 4, 3·6 tons carbonate of lime; plot 5, 1 ton burnt lime and 3 cwt. inoculated soil; plot 6, 1 ton burnt lime and 6 cwt. inoculated soil; plot 7, 1 ton burnt lime and 9 cwt. inoculated soil; plot 8, no lime, 3 cwt. inoculated soil; plot 9, no lime, 6 cwt. inoculated soil; plot 10, no lime, 9 cwt. inoculated soil.

These applications were made on a damp day, 3rd December, the plots being cultivated and harrowed immediately after the lime and inoculated soil were applied. No further cultivation was given. The weather continued dry, and growth was not abundant on any of the plots. The outstanding plots regarding colour and evenness of growth were Nos. 3, 4, 7, and 10, plots 3 and 4 being, if anything, the best. It is evident that inoculated soil is beneficial even where bacteria are already present. This was quite apparent in plot 10, where 9 cwt. of inoculated soil per acre was used. Although nodules were plentiful on the roots of the plants in the control rows on either side of this plot, the plot itself was outstanding, having as good an appearance as plot 7, which was treated with 1 ton burnt lime and 9 cwt. soil per acre. Good rains would undoubtedly have benefited the limed plots, and it is probable they will show to better advantage in the spring.

POTATOES.

An area of 2¾ acres was used for various potato trials, the previous crop having been lucerne sown in 1917. The land was autumn-ploughed, cross-ploughed in the spring, and worked to a fine tilth.

Treatment of Seed for Control of Powdery Scab.—For this test Dakota variety table potatoes cut into sets were used, the tubers, except where otherwise specified, being affected with powdery scab. It is a common belief that lime tends to induce scab, hence lime was tried with and without chemical preventives. The limings were with crushed limestone at the rate of 3 tons per acre, applied at time of planting. The scheme was as follows: Plot 1, no treatment; plot 2, limed; plot 3, corrosive sublimate, 1 oz. to 6 gallons; plot 4, corrosive sublimate, and limed; plot 5, formalin, 1 pint to 30 gallons; plot 6, formalin, and limed; plot 7, clean seed, no treatment; plot 8, clean seed, limed. Date of planting, 18th November.

From 70 to 80 per cent. of the tubers used for the experiment rotted in the ground, due, no doubt, to the tubers being cut. There were fewer blanks in plots 3, 7, and 8 than in the other treatments. The result of the test was that when the crop was lifted all tubers were perfectly clean, including the produce of the scabby seed.

Origin of Seed Test.—This was to obtain data as to the producing-capacity of seed of the same variety from different parts of the Dominion.

The Gamekeeper variety gave the following yields per acre in tons: Palmerston North seed—Table, 8·52; seed, 2·65; pig, 1·22—total, 12·39. Canterbury seed—Table, 7·39; seed, 2·92; pig, 1·15—total, 11·46. Southland seed—Table, 8·99; seed, 2·07; pig, 1·15—total, 12·21. The Southland potatoes were the latest to ripen and had the biggest percentage of table potatoes, some of the tubers being very large. Potatoes from the three plots appeared equally sound when they were dug.

Arran Chief yielded as follows, in tons per acre: Pukekohe seed—Table, 3·08; seed, 1·27; pig, 0·36—total, 4·71. Southland seed—Table, 8·39; seed, 3·27; pig, 1·07—total, 12·43. Canterbury seed—Table, 10·18; seed, 3·36; pig, 1·17—total, 14·71. The three plots ripened off about the same time. The tubers of Pukekohe origin were apparently sound when planted, but about 40 per cent. rotted without putting up a shoot, the comparison being thus vitiated to that extent.

Variety Test.—For this trial one row of each variety, 4 chains 8 ft. long, was planted on 19th November, the sets being 15 in. and rows 30 in. apart. The yields in tons per acre were as follows:—

Variety.	Table.	Seed.	Pig.	Total.
	Tons.	Tons.	Tons.	Tons.
Snowflake	5·718	0·515	0·114	6·347
Arran Chief	6·433	3·831	1·430	11·694
Up-to-Date	5·146	2·373	0·715	8·234
New Era	6·490	3·861	1·030	11·381
Breeze's Prolific	6·118	2·172	0·790	9·080
British Queen	7·433	3·259	1·030	11·722
Snowdrop	7·633	4·089	1·687	13·409
Gold Coin	9·893	1·544	0·743	12·180
Manhattan	6·833	2·459	0·744	10·036
Reading Russet	9·092	4·117	1·144	14·353
Dakota	8·348	1·829	0·744	10·921

Gold Coin is the earliest of these varieties. It crops heavily and yields a high percentage of marketable potatoes. It may not be a keeper, but the quality is good early in the season. New Era was the latest to ripen off. It appears to be a variety that would yield a high percentage of small potatoes if grown on light land, as the table potatoes produced were small in size although of a good shape. Reading Russet cropped well and has a good appearance, though the percentage of small tubers was high. As the land where these varieties were planted is very uniform, the weights give a fair indication of their cropping-powers.

Main Crop.—An area of some 2 acres of potatoes was planted between 20th and 24th November for the farm main crop, the Dakota variety being used. The estimated yield per acre of marketable tubers was 7 tons.

On a part of this area cut seed was used with varying results. Although at one time much in favour, there appears to be a risk in

using cut potatoes for seed, at least for some present-day varieties. Cutting evidently lowers the vitality of the Dakota potato, particularly if planting is delayed for any length of time after the tubers are cut. Tubers cut and planted forty-eight hours afterwards failed almost entirely. Some cut and planted within a few hours did much better, while those cut and planted at once did about equally well. In all cases the cut-seed rows were weak-looking and blanky compared with rows where whole seed was used. The cut seed produced potatoes of good size, but this is usually the case when there are blanks in a potato crop, the tubers being large according to space allowed between the sets. It seems that Arran Chief tubers will not keep their vitality for a lengthy period after being cut, as evidenced by the failures in cut *versus* uncut seed tests, where with cut table potatoes every tuber failed. These potatoes were cut in Christchurch, and a few days elapsed between time of cutting and planting. Notwithstanding this they appeared quite sound and sappy at the time of planting.

The main crop generally was free from disease, though an occasional scabby potato was noticed among the varieties and in the other tests.

MISCELLANEOUS.

A 5-acre paddock of tall oat-grass (*Arrhenatherum avenaceum*) was closed for seed and a light yield obtained. The grass ripened very unevenly, and no doubt this characteristic accounts to some extent for the low germinating-power of the seed of this species. The crop was harvested on 23rd December, and very little aftergrowth took place. Small areas of prairie-grass (*Bromus unioloides*) and canary-grass (*Phalaris bulbosa*) were grazed with stock. The former was much relished by both sheep and cattle, while the latter did not appear highly palatable, though it withstood the dry weather well. A 2-acre field of Danish cocksfoot, sown in the Danish system of wide drills, was established for seed-production.

Grimm lucerne plants were planted on an area of 1 acre, in rows 2 ft. 6 in. apart, and 2 ft. 6 in. apart in the rows. This plot will be closed for seed-production at a later date.

An extensive experiment on the laying-down of pastures with and without oats as a cover-crop was set out. The very dry season, the patchy nature of the land, and the subsequent attack of grass-grub made it necessary to abandon the experiment.

In a test on the size of seed-potatoes the medium-sized seed gave the best results in yield.

The success of the work carried out on the farm has been largely due to the ability and keen interest of the Overseer, Mr. J. G. McKay, whose valuable co-operation is cordially acknowledged.

Horses on Swedes.—Draught horses (when not working or when on light work) do well on swedes in the field, provided they are also given a little hay or have a run-off on grass.

INSECT PESTS OF LUCERNE AND CLOVER.

OBSERVATIONS IN THE MARLBOROUGH SEED-GROWING AREA.

J. G. MYERS, F.E.S., Biological Laboratory, Wellington.

In this article two important foreign pests of the lucerne and red-clover seed industry are recorded in New Zealand for the first time; several native insects are convicted of damaging the same crops; and all the other insects known to attack these plants in New Zealand are discussed, together with the beneficial insects which form an important factor in their control. Much of the related field-work was carried out last March in the Marlborough seed-growing district, where the writer received considerable assistance from Messrs. C. W. Parker and Co., of Blenheim.

INSECTS COLLECTED IN THE FIELDS.

Lucerne.

Harmful.—Zizera labradus, blue butterfly; *Chloridea obsoleta,* tomato-caterpillar (rare); *Plusia chalcites,* maize-looper caterpillar (rare); *Nysius huttoni* (very common); thrips sp. (near *Heliothrips fasciatus*).

Useful.—Apis mellifica, hive-bee (responsible for all pollination); *Melanostoma fasciatum* and *Syrphus novae-zealandiae,* hover-flies; *Coccinella 11-punctata,* 11-spot ladybird; *Reduviolus* sp. (very common predaceous bug); *Lycosa* sp. (small spider, very common); *Austrolestes colensonis,* blue dragon-fly.

Not known nor present in Sufficient Numbers to be injurious.—Eristalis tenax, drone-fly; *Lauxania bilineata,* fly; *Sarcophaga impatiens,* flesh-fly; *Crambus flexuosellus, Leptomeris rubraria,* and *Hydriomena subochraria,* moths; *Vanessa cardui,* painted-lady butterfly; *Gryllus servillei,* Australian black cricket; *Lissotrachelus maoricus,* New Zealand cricket; *Pachytylus cinerascens,* New Zealand locust; *Dictyotus caenosus,* chequered plant-bug.

Red Clover.

Harmful.—Bruchophagus funebris, clover-seed chalcid; *Nysius huttoni,* Hutton's Nysius; *Rhopalimorpha obscura,* one-striped plant-bug; *Aphis bakeri,* clover-aphis; *Chloridea obsoleta,* tomato-caterpillar; *Zizera labradus,* blue butterfly.

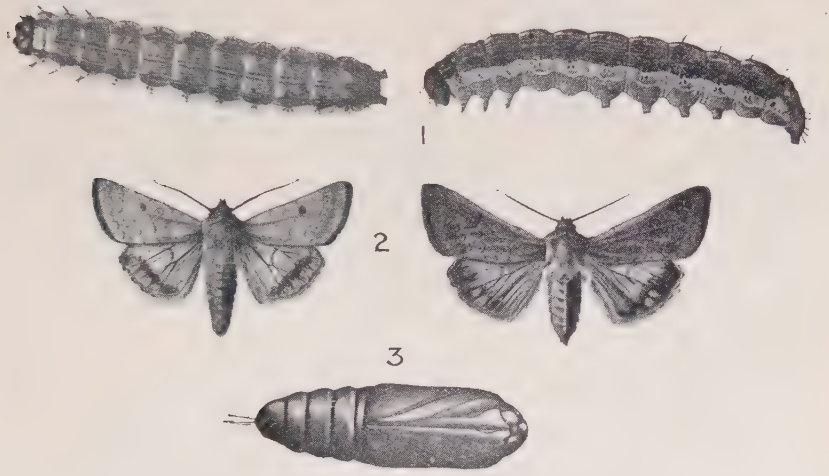
Useful.—Melanostoma fasciatum and *Syrphus novae-zealandiae,* hover-flies; *Apis mellifica,* hive-bee; *Bombus* spp., humble-bees (pollinating the flowers); *Probolus invectus* and *Ichneumon* sp., ichneumon-wasps; *Reduviolus* spp. (predaceous bugs); *Austrolestes colensonis,* blue dragon-fly; *Micromus tasmaniae,* lacewing fly.

Not known to injure Crops of any Kind or not plentiful enough to do Harm.—Sarcophaga impatiens, flesh-fly; *Lauxania bilineata,* fly; *Dictyotus caenosus,* chequered plant-bug; *Leptomeris rubraria* and *Crambus flexuosellus,* moths; *Lissotrachelus maoricus,* New Zealand cricket.

CHLORIDEA OBSOLETA (TOMATO-CATERPILLAR).

Perhaps the most noticeable pest up to the present has been the caterpillar of *Chloridea obsoleta* (Fig. 1), attacking both red clover and lucerne. It is responsible for extensive damage throughout the world to an extraordinary variety of cultivated crops, including tomatoes, tobacco, maize, cotton, garden-plants, lucerne, and clover. The favourite point of attack, in distinction to that of army-worms and cutworms, is the bud, inflorescence, or shoot—in short, any position which offers an abundance of rather concentrated nourishment in a small space. In keeping with this the caterpillar attacks the flower-heads of both clover and lucerne, thus doing considerable harm to the seed industry.

In the Blenheim red-clover fields in March the caterpillars were in great numbers and of all ages, but consisting chiefly of half-grown



CHLORIDEA OBSOLETA (TOMATO-CATERPILLAR).

Fig. 1. Caterpillars (slightly enlarged). Fig. 2. Adult moths, showing variation in markings (slightly reduced). Fig. 3. Pupa (enlarged about twice).

[*After Kentucky Agricultural Experiment Station Bulletin No. 187.*

specimens, occurring plentifully in standing clover crops from those only just in flower to those about to be cut for seed. In practically all cases the flower-heads were attacked, and in such force that as many as twenty larvæ were found in the net after one sweeping. Newly hatched caterpillars were found at the base of the flower-heads, among the florets. The larger caterpillars were feeding quite openly on the flower-heads at midday, and sparrows in small flocks were apparently feeding on them. The moths (Fig. 2) themselves were extremely common, both sexes flying very rapidly in the sunlight—contrary to the usual habit of moths—and feeding at the clover-flowers.

In former years the lucerne has been almost as badly attacked as the red clover by this caterpillar, but this year the lucerne-fields were found practically untouched. The caterpillars vary in colour

from almost uniform green to brownish, with or without numerous marks, spots, and stripes of blackish, white, or pale-greenish. When full-fed they descend to the ground, and, after burying themselves to a depth of a few inches, change to the quiescent or pupa state, in which the winter is passed (Fig. 3). There are at least two broods.

Sparrows probably account for a large number of the caterpillars, especially during the breeding season, when insects form almost the sole food of the young. The two large ichneumon-flies found so abundantly are of species which are known to attack large caterpillars such as these.

APHIS BAKERI AND "STICKY" CLOVER-SEED.

I examined bulk samples of "sticky" red-clover seed at the warehouse of Messrs. Parker and Co., and found no insect-remains. Mr. A. H. Cockayne gives the information that a precisely similar complaint is caused in North America by *Aphis bakeri* Cowen, a

APHIS BAKERI.

Fig. 4. Winged female, × 15. Fig. 5. Wingless female, × 15.

[*After Colorado Agricultural College Experiment Station Bulletin No. 133.*

species of plant-louse not hitherto recorded from New Zealand. At Blenheim, in two fields of red clover just about to be cut for seed, and situated in the centre of the area which yielded most sticky seed last year, I found aphis plentifully. These specimens have since been determined indubitably as *Aphis bakeri* (Figs. 4, 5). The quite dry clover-heads, in which the stalk was shrivelled and brown, contained no aphids; but of those in which the head was practically dry and brown, though the base and flowering-stalk were still green, there were areas in which practically every such head was infested. The insects were always clustered among the bases of the florets and inside the bract which covers the base of the whole head. I found none in flowers of which the petals were still pink. The "stickiness" of the seed, which causes masses as large as one's fist to cling together in such a refractory manner as to defy all treatment, is apparently produced by the honey-dew secreted by these aphids in the flower-heads.

In America, where this pest has been studied, the insect spends part of its life-cycle on other plants, particularly apple-trees, where it has been confused with other apple plant-lice. In autumn some

of the winged individuals leave the clover and fly to apple-trees, where the winter eggs are deposited. These hatch in the spring and give rise to a brood the descendants of which migrate again to the clover. Next season it is hoped definitely to ascertain whether the same state of affairs holds in this country, but until this investigation is completed no means of control directed with the idea of clover as the sole food-plant will be of much avail.

Meanwhile, however, there are certain natural enemies which are doing a surprising amount of good. The grubs of the lacewing fly (*Micromus tasmaniae*) and of the two hover-flies (*Melanostoma fasciatum*) and (*Syrphus novae-zealandiae*) all feed on aphids, and all occurred among the infected plants, the two latter in enormous numbers. The aphids, however, are so well hidden among the florets that attack by predaceous enemies must be considerably less than would otherwise be the case. There is, however, an unidentified hymenopterous insect which had parasitized at least half of the full-grown aphids collected

BRUCHOPHAGUS FUNEBRIS (CLOVER-SEED CHALCID).

Fig. 6. Adult chalcid. Fig. 7. Larva. Fig. 8. Pupa. (All enlarged.)

[*After United States Department of Agriculture Bulletin No. 812.*

by me. The skin of the victims, turned from greenish to black, was filled completely with the pupa (quiescent and full-fed grub) of the wasp. I have, unfortunately, been unable yet to breed out the adult wasps.

THE CLOVER-SEED CHALCID (SO-CALLED "WEEVIL").

For some years past both lucerne and red-clover seed has occasionally occurred here with a considerable percentage attacked by an insect which, dwelling within the seed, rendered its shape deformed and swollen, and otherwise showed its presence by the ease with which such seeds (which were, of course, entirely useless) were crushed between the fingers (Figs. 11, 12). Specimens of these were bred out and proved to be the famous clover-seed chalcid (*Bruchophagus funebris*) (Fig. 6) of America. The mature insect is a minute black wasp belonging to a family the majority of which are highly beneficial as parasites of injurious insects. These little wasps were extremely abundant in the Blenheim fields, especially in red clover which was about to be cut for seed. The lucerne is attacked to a much lesser extent, and the adults were not found in any of the areas of lucerne which I examined.

THE CLOVER-SEED CHALCID.

Fig. 9. Egg. Fig. 10. Larva in hollow lucerne-seed. Fig. 11. Lucerne-seeds hollowed out by chalcid. Fig. 12. Cluster of lucerne seed-pods from which adult chalcids have emerged. (All enlarged.)

[*After United States Department of Agriculture Bulletin No. 812*

The females lay their eggs (Fig. 9) in the withered heads, in which the seed, while more or less full-grown, is still juicy. An unripe seed is not only necessary for the food of the young larva, but also to enable the female to pierce it in egg-laying. By the time the larva (Figs. 7, 10) is full-fed there is nothing left of the seed but the outside skin. The larva, however, remains therein till spring, and renders the affected seed heavy enough to remain with the sound seed during cleaning operations. In America there are at least three generations per year.

Not only does *Bruchophagus funebris* affect very materially the quantity of the seed crop, but it perpetuates itself from the sowing of affected seed. It is unfortunate for any system of control that the insect is most abundant at the very time when ripening seed-heads are most numerous and yet not ripe enough to cut. Self-sown clover-plants on the edges of fields or among other crops are particularly liable to attack, and should be invariably destroyed if practicable. Apparently red clover is the chief host-plant, with lucerne next. Other clovers are not attacked. No natural enemies have yet been found in New Zealand. Unquestionably this insect is the chief factor in reducing the yield of red-clover seed, in the Marlborough area at least.

This species has probably been introduced into New Zealand from North America, which is apparently its home, or from Australia, where Froggatt first recorded it a few years ago.

PLANT-BUGS, ETC.

Perhaps the commonest insect in the fields, both of lucerne and red clover, is the small, grey, exceedingly malodorous plant-bug *Nysius huttoni*. This is a very close relative of the destructive chinch-bug of North America, of the Rutherglen bug of New South Wales, and of several other injurious species. This bug has also occurred in phenomenal numbers, chiefly as nymphs (undeveloped young) on the ground, in a lucerne crop near Wellington. This particular crop was interspersed with practically worthless patches, which formed a very large proportion of the whole, but which were confined to drier areas and were too distinctly marked to be due solely to insect agency. *Nysius* simply swarmed among these stunted plants. In Blenheim, where the crops examined were much more uniform and also more advanced, the bug was common throughout, and, while no

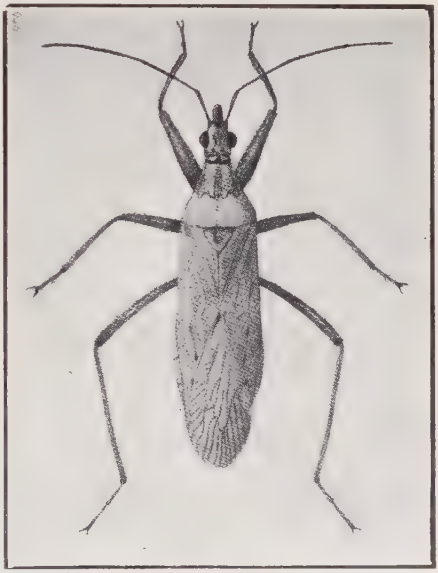


FIG. 13. ADULT REDUVIOLUS, × 7.

[*After Kentucky Agricultural Experiment Station Bulletin No. 187.*

damage was apparent, the continual drain on the crop by the sucking of these innumerable insects must be a factor of some importance. It should be noted that *Nysius huttoni* is a native species, which, besides occurring on numerous indigenous plants, also feeds on a wide variety of cultivated species.

Among other plant-bugs not yet convicted of extensive damage is the one-striped plant-bug (*Rhopalimorpha obscura*), another endemic species, which sucks the unripe seeds of cocksfoot and other grasses, and occurs in considerable numbers both as nymphs and adults in lucerne and red-clover crops.

Among lucerne and clover crops the little greyish-blue butterfly (*Zizera labradus*) is very common. Its flat, greenish caterpillar feeds to a large extent on clover, lucerne, and allied plants, and has in Australia been recorded as a serious pest. In New Zealand it may be reckoned among those insects which will be of serious importance only if they increase to much greater numbers.

The long-legged, active bugs of the genus *Reduviolus* (Fig. 13) are extremely common among the plants, and are purely beneficial, living on other insects, but probably not confining themselves so strictly to the injurious species as to be of very great assistance in their control. They do, however, account for a large number of the caterpillars, which are a favourite prey.

WHITE CLOVER ON THE TAIERI PLAIN.

WHITE clover grows more or less naturally on the Taieri Plain, there being no need for the farmers there to include the seed in their grass-mixtures. The persistence of this clover is really remarkable, and in many cases long-established rye-grass pastures contain an abundance of white clover which appears to be more or less permanent. This may be accounted for by a certain amount of natural selection taking place, the shorter-lived strains disappearing during the first few years of the pasture's existence. An examination of individual plants appears to show in some cases propagation from vegetative stools, but in the majority of cases the growth of clover from season to season is kept going by natural reseeding. Several inquiries have recently been received by the writer for information in connection with "wild white clover," on account of the various favourable reports which have from time to time appeared in connection with this plant. There can be no doubt that the white clover growing in the long-established rye-grass paddocks of the Taieri Plain is practically the same as the European wild white clover, and in view of the fact that the price of the imported seed ranges from £1 10s. to £2 per pound one certainly cannot recommend such seed when strains having similar characteristics may be procured locally at a much cheaper rate.—*R. B. Tennent, Instructor in Agriculture, Dunedin.*

SOME RECENT CHANGES IN THE NAMES OF PLANT-DISEASES.

G. H. CUNNINGHAM, Biological Laboratory, Wellington.

INTRODUCTION.

DURING the past decade many changes have been made in the scientific names of those fungi and bacteria which are the cause of orchard, garden, and field-crop diseases. Although the adoption of these changes has been necessary in any attempt to bring the matter of the naming of such fungi and bacteria up to date, it has been the cause of a great deal of inconvenience and dissatisfaction to those familiar only with the older names. In many cases, indeed, the use of the correct modern scientific name has led to great uncertainty in the minds of orchardists, gardeners, farmers, and even instructors, as to exactly what disease it refers.

The purpose of these articles is, firstly, to show what scientific names should be definitely accepted, reasons being given for any changes that have had to be made; secondly—and this is of greater importance to the practical man—to attempt the standardization of common names so far as New Zealand is concerned, so that orchardists and farmers following the articles will know that when in future the common name of any particular disease is mentioned in any publication of the Department of Agriculture it applies to that disease and to no other.

"Why have a scientific name at all?" is a question that is often asked. "Why not apply a common name and have done with it?" That this is untenable will be made plain from an example.

The most serious fruit-tree disease is undoubtedly fireblight, caused by *Bacillus amylovorus* (Burr.) Trev. In New Zealand this is known as fireblight, but in North America it is called twig-blight, blossom-blight, collar-blight, fruit-blight, blight-canker, pear-blight, root-rot, and fireblight. If so much confusion can arise in the case of one organism of such limited distribution (being confined to North America and New Zealand) it may be better imagined than described what the position would be when it came to the naming of a fungus of cosmopolitan distribution, of which there are many thousands. Instead of being able to make use of a name universally accepted all over the civilized world and belonging to no other fungus, the unfortunate mycologist who wished to refer to such a fungus would find himself confronted with a list of perhaps some hundreds of local names in dozens of different languages.

It is easy to see that such a state of affairs would result in absolute chaos, and it has been the need of avoiding this, and not, as many people seem to think, an undue love of high-sounding words among scientists that has brought about the gradual evolution of the present system of botanical nomenclature. In the early days of science Latin served as a kind of universal language among the learned, and not unnaturally came to be used by those who first made a study of the classification and accurate naming of plants. Nothing more satisfactory has been found, and Latin, and to a smaller extent Greek—often in the modernized form—are now universally used for this purpose.

In botanical literature two names are always employed to designate each species. Under the first or generic name are collected all those species which agree in the possession of certain characters not shared by other species—for example, *Puccinia*, the name of a genus that includes most of the rusts. In addition to its generic name, which it may share with a number of other species, each member of the genus is given a specific name which belongs to it alone—for example, *Uromyces Fabae de Bary* (broad-bean rust); *Uromycladium Tepperianum* (Sacc.) McAlp. (an acacia rust); *Puccinia Pruni-spinosae* Pers. (leaf-rust of stone-fruit trees).

It will be noticed that after *Puccinia Pruni-spinosae* appears the word "Pers." This is an abbreviation of the name Persoon, and is here used after the specific name to indicate that Persoon was the mycologist who first described that particular species. Frequently two such names are appended, one being in brackets; in such case the name in brackets indicates that although for various reasons the genus in which this species was first placed was not tenable, the original specific name was retained by the author who transferred the species to its correct genus. For example, the rust *Uromycladium Tepperianum* (Sacc.) McAlp. was in 1889 described as *Uromyces Tepperianus* by Saccardo. In 1906 McAlpine placed it in his new genus *Uromycladium*, retaining the specific name *Tepperianus* as used by Saccardo. The inclusion of the name in brackets is optional, and is not adopted by certain of the more recent systematists. In these articles it will be followed only when the specific name first used was applied to the perfect stage of the fungus.

Having cleared up the matter of the use of botanical names and the necessity for them, we are now able to discuss the reasons that have led to the alterations in names of fungi and bacteria. These reasons will be dealt with briefly as follows:—

CHANGES NECESSITATED THROUGH THE PERFECT STAGE OF THE ORGANISM BECOMING KNOWN.

In certain groups of fungi two or more stages of the one fungus exist. For example, the familiar black-spot of apples has for a long time been known to have been caused by the fungus *Fusicladium dendriticum* Fcl. Later research has shown that *Fusicladium* is but one stage—the conidial stage—in the life-cycle of the ascomycetous fungus *Venturia inaequalis* (Cke.) Aderh.; so that we may have two or more names applied to one organism during different phases of its life-cycle.

When once the perfect stage of a fungus becomes known, all the names that have been applied to the various conidial forms in its life-cycle automatically become synonyms. This practice is not entirely satisfactory, as it means that any of those fungi at present known only in the conidial or imperfect stage—and of these there are many thousands—are liable to changes in generic name so soon as the perfect stage is described. As the perfect stage of many such imperfect fungi is described each year, the result is a continual changing of nomenclature. Frequently, when the connection between the imperfect and perfect stages becomes known, it is found that the perfect stage has already been described; when such a case occurs the name of the perfect stage of the fungus is retained, the name of the imperfect stage being no longer

used. In other cases the perfect stage has been developed in cultures from the imperfect stage and found to be undescribed; when this occurs the perfect stage is named, and the name of the imperfect stage is discarded.

CHANGES NECESSITATED THROUGH THE GENERIC NAME BECOMING UNTENABLE.

In the early days of mycology many genera were erected on characters which later research has shown to be untenable or otherwise inadequate as generic distinctions. Such an instance occurs where a genus has been founded solely on biological distinctions. Take the example of the well-known "leaf-curl" of the peach. In earlier works this species was placed in the genus *Exoascus*. This genus was separated from *Taphrina* on the assumption that the species in it were possessed of perennial mycelium, whereas in *Taphrina* the mycelium was supposed to be annual. But when critically examined this distinction breaks down, many species placed in the genus *Exoascus* possessing annual mycelium, and *vice versa*. In accordance with the rules of priority the older of these two genera (*Taphrina*) is retained. In this Laboratory, where systematic work is so essential to the proper study of mycology, it is understood that a genus or species is not tenable unless it presents distinctive morphological characters. Again, when a genus has been split up by later workers the original generic name is retained for part, new genera being erected whenever morphological distinctions have been sufficient to warrant such action being taken. In such a case the original specific names are retained, the generic name alone being altered. Such an example occurs with *Plowrightia morbosa*. This was first described by Schweinitz as a *Sphaeria*, but when this genus was later broken up this species was transferred by Saccardo to the genus *Plowrightia*.

CHANGES NECESSITATED BY THE RULES INSTITUTED BY THE INTERNATIONAL BOTANICAL CONGRESS, AT BRUSSELS, IN 1910.

In clause 49 of these rules it is laid down that the first specific name applied to the perfect stage of a pleomorphic fungus when placed in its proper genus shall stand. As the first systematic mycological work was done by Persoon (1801) and Fries (1821–32), at the Brussels Congress it was agreed to use the works of these two authors as the starting-point from which the accepted nomenclature should begin. It was agreed that all names prior to these publications, if not included in them, would be rejected. This is entirely opposed to the American botanical rules, which hold that the first name, whether applied to any fungus or any stage of any fungus, shall hold.

As an example, *Nectria cinnabarina* was in 1791 called *Sphaeria cinnabarina* by Tode. In 1849 it was placed by Fries in the genus *Nectria*, the specific name of Tode being retained. In 1909 Seaver named this fungus *Creonectria purpurea*. The genus *Creonectria* was erected by Seaver (an American mycologist), the specific name *purpurea* being derived from the name *Tremella purpurea*, which was supposed to have been applied to this plant in 1753 by Linnæus. Should the genus *Creonectria* be recognized, then the name of this fungus becomes *Creonectria cinnabarina*, and not *Creonectria purpurea*.

CHANGES NECESSITATED BY THE PREVIOUS USE IN NEW ZEALAND OF CERTAIN NAMES SANCTIONED BY THE AMERICAN RULES OF BOTANICAL NOMENCLATURE, BUT NOW UNTENABLE UNDER THE INTERNATIONAL RULES.

In theory the American rules are very simple, being to the effect that the first published specific name is the one to be adopted, irrespective of whether the generic name with which it was associated was correct or not. The disadvantage of this system lies in the difficulty of being certain amidst the confusion of the earliest botanical literature what the first specific name really was. Owing to the large amount of American plant-disease literature that enters New Zealand, many of our common diseases are better known under their American scientific names than their international scientific names.

CHANGES NECESSITATED THROUGH THE PREVIOUS WRONG DETERMINATION OF THE CAUSATIVE ORGANISM.

Faulty determinations are due to the following causes :—

(*a.*) In the earlier part of last century, when fungi were little known and communication between mycologists was difficult, it was a common practice for each individual worker to assume that any fungus that he had not seen before must be undescribed. It would then be published as a new species, the name in many cases being accompanied by so imperfect a description that, save by an examination of the type (the actual specimen from which the original description was drawn up), it has often proved impossible to determine what plant it was to which the first published description referred. In the different colonies, where the flora was little known, collectors were busy despatching large quantities of plants to the few workers who were engaged on the study of fungi. Consequently from New Zealand were sent numbers of fungi which were named and "described" abroad, the types being deposited in many different herbaria. A number of these types having disappeared, actual comparison was afterwards impossible, but this did not deter many of those to whom specimens were sent later on from "diagnosing" the species, frequently wrongly. Consequently, as many of the earlier departmental specimens were sent abroad, wrong names were common in our earlier reports.

(*b.*) In certain cases, before proper equipment and literature had been procured, determination of a specific organism was attempted in New Zealand. Whilst this method was often successful, at times errors in determination have been made, not so much from inaccurate comparison with the supposed causative organism, but rather from the fact that as little or no cultural work was attempted the true disease-producing organism was not obtained, saprophytes being studied and compared instead. This was a common source of error with earlier European and American workers; in fact, until recently the association of the fructifications of a fungus with a diseased condition of the host, such as a canker, leaf-spot, &c., was considered as sufficient proof that the associate fungus was the real cause of the trouble.

NOTE.—The names of the various organisms producing the commoner diseases of fruit-trees, field-crops and garden-plants will be dealt with in the several parts of this article to follow.

(To be continued.)

OTAGO BOYS' AGRICULTURAL COMPETITIONS.

R. B. TENNENT, N.D.D., Instructor in Agriculture Dunedin.

THE boys' agricultural competition held under the control of the educational committee of the Otago Expansion League was brought into being in June, 1918. The credit for the inception of the proposal belongs to Mr. E. S. Green, Agricultural Instructor to the Otago Education Board, who is a member of the committee.

No claim is made of originality regarding the proposals for assisting in attaining the committee's aim. The idea was suggested by the success following on the employment among the youth in other places of that great incentive to maximum effort — competition. In the United States, for example, boys' agricultural clubs had been esta-

GREEN ISLAND SCHOOL COMPETITORS (SEASON 1920–21).

blished in a small way, and since attained a scope and shown results which had more than exceeded even the most sanguine hopes of the promoters. Farm-crop competitions had also been established in New South Wales and Queensland, and it was apparent that competitions on similar lines, modified to suit local conditions, would, if properly organized under the auspices of the League, attain equally satisfactory results here. With the agricultural progress of recent years many of the old practices had been superseded by new methods based on the results of scientific investigation, and it was generally recognized that the best promise of the most profitable employment of improved methods comes from those who would be the farmers of to-morrow.

It was proposed that, as an initial experiment, the school-pupils' competition already established by the Education Board and the Otago Agricultural and Pastoral Society be extended under the auspices

of the Expansion League to embrace the cultivation of certain staple products on the home farm. To ensure the working of the scheme it would be necessary to have local organizations, and in this connection it was suggested that a necessary preliminary would be to enlist the co-operation of country school-teachers, School Committees, and representatives of the League in centres where the competitions were established.

The League's committee adopted the suggestions, and the following rules were drawn up for the guidance of the competition :—

(1.) The object of the competition shall be to stimulate the interest of the youthful generation in agricultural pursuits and foster a love of country life.

(2.) The competition shall be limited to schoolboys between the age of ten and sixteen, and confined to the growing of certain staple products.

(3.) The area to be cultivated shall be an eighth of an acre, and may be a portion of the home farm, or area otherwise arranged for.

(4.) All work involved, except where heavy implements and horse-power may be necessary, must be done by the competitor.

(5.) Only one variety of the crop to be grown in each plot.

(6.) No plant to be within 1 ft. of the boundary of the plot.

(7.) All seed and manures to be provided by the competitor.

(8.) The competition to be judged on the following basis : (*a*) Greatest yield of marketable crop, 50 per cent. ; (*b*) best-kept record descriptive of cultivation operations, observations on rainfall, and special conditions affecting the crop, such as prevention of blight, dealing with pests, &c., 30 per cent. ; (*c*) greatest profit per acre, 20 per cent.

(9.) The judging of the competition to be in the hands of the committee of disinterested persons nominated by the executive of the Otago Expansion League.

(10.) The prizes shall be—First, gold watch, value £10 ; second, value £4 ; third, value £3 ; fourth, value £2.

(11.) The crop for 1918–19 shall be potatoes.

Records should give details as to the following : Dimensions of plot ; kind of soil and nature of subsoil ; depth of topsoil ; crop grown on plot last year ; preparation of plot for potato crop ; quantity of seed-potatoes used per acre ; variety of seed ; special treatment of seed (if any) before planting ; method of planting ; depth of planting ; distance between rows and distance apart in the rows ; date of planting ; subsequent cultivation ; quantity and kind of fertilizer (if any) used ; treatment of growing crop for prevention of blight, &c. ; any special conditions affecting crop ; date of digging ; yield of marketable tubers from plot ; rate per acre of yield.

The candidates were also asked to append to their records answers to the following questions :—

(1.) What is the average yield per acre of potatoes on similar land in your district ?

(2.) Where did you get your information regarding the cultivation of potatoes ?

(3.) What improvements would you make in your work if you were growing another crop ?

(4.) Have you found this competition of interest ?

In the calculation of the net profit, details as to the following were required :—

(*a*.) Cost of preparatory and subsequent cultivation operations, such as ploughing, harrowing, hilling, &c. (Calculate cost at current farm rates for these operations.)

(*b*.) Cost of fertilizer, if any used (if farmyard manure used, allow 10s. per ton).

(*c*.) Cost of seed-potatoes (at current farm rates).

(*d*.) Cost of planting (at current farm rates).

(*e*.) Cost of digging and bagging (at current farm rates).

(*f*.) Rent of plot (calculate at 5 per cent. on valuation of land).

(*g*.) Any additional cost (give details).

Total cost of production.

Total value of crop at market price.

Net profit.

Net profit per acre.

Other particulars were formulated as follows :—

Records to reach the Secretary, Otago Expansion League, Dunedin, on specified date.

The competitors are asked to sign the following certificate : I hereby certify that my record of work done and observations made is correct in every particular. Signature of competitor..... Age..... School..... Date.....

Supervisors' certificate : We, the undersigned, hereby certify that the information regarding the yield of marketable tubers furnished by.....is correct, and that the rules of the competition have been observed. Signature..... Address..... Signature..... Address.....

Parent's report : (1.) Has your boy been interested in the cultivation of his plot ?..... (2.) Do you consider the competition of value as an experiment ? ..... (3.) Make any comment you may deem desirable.....

Copies of these rules were sent out to a number of schools, along with a supply of Agriculture Department's bulletin "Potato-growing for Small Areas."

GENERAL VIEW OF THE BEAUMONT PLOTS.

Two schools, Beaumont and Momona, entered for the first year (1918–19), a total of twelve competitors taking up the work. Several other schools notified that they would enter for further competitions, but were then committed to the school-garden competitions of the Otago Education Board. A silver cup, presented by Mr. W. Stuart Wilson, was offered for the school gaining the highest percentage of marks in the competition, and this cup, together with the gold watch, went to Beaumont School, the first prize being won by William P. Collins. The experience of the year proved to the committee that the plot of land was too large for children to cultivate properly, and, after consultation with teachers, supervisors, and other interested persons, the area was reduced to $\frac{1}{40}$th of an acre.

For the second year (1919–20) a plot of land adjacent to Beaumont School was secured and properly fenced. This competition received

twenty-nine entries, Hampden School entering in addition to Beaumont and Momona. The results were very satisfactory. The cup was won by Momona School, the first prize being awarded to George McLeod. During the year a Dominion challenge cup was presented by Mr. W. Stuart Wilson, to be held by the competitor registering the highest number of marks in any boys' competition in the Dominion. In this case the adjudicator was Dr. C. J. Reakes, Director-General, Department of Agriculture, who awarded the trophy for 1918–19 to William P. Collins, and for 1919–20 to George McLeod, these names being engraved upon it.

In the 1920–21 competition six schools — Beaumont, Momona, Hampden, Green Island, Ngapara, and Papakaio—took part. The winner of the first prize was O. Gould, of Hampden School, who, with the Arran Chief variety, secured a yield of 22·07 tons per acre, showing a profit of £63 17s. per acre; he was awarded a total of 96 marks, 50 being for yield, 20 for profit, and 26 for the essay. Second, third, and fourth places were filled by George Ford, Jessie Ford, and Keith McLeod, all of Momona School. These three competitors grew Sutton's Supreme variety, and all secured yields of over 20 tons per acre. Their total marks were 91, 90, and 78 respectively.

The ensuing season's competition gives excellent promise, fifty-one entries having been received at time of writing.

The success attending the competitions has been most gratifying to the committee, the yield of the crops, the eagerness of the competitors, and the interest of the parents and teachers being most marked. Yields of over 20 tons to the acre secured by the chief competitors speak highly for the industry and intelligence of the growers, while the hope of winning the gold watch lends that air of emulation and sporting chance which appeals to the heart of young New Zealand.

The competition was launched as a boys' competition, but the girls were determined that they would not be left out of it. This year seven girls competed, one of whom secured third place. The Otago Agricultural and Pastoral Society allowed competitors this year to enter at the winter show among the school entries, and several prizes were secured, while one girl competitor valiantly entered the open competition of the show and secured a second prize against some of the best potato-growers in Otago.

The Department of Agriculture has entered into co-operation with the Otago Expansion League by granting a pound-for-pound subsidy on reasonable expenditure for the competition. The Department is represented on the competition committee by the writer, as Instructor in Agriculture for the district, and he has also acted as adjudicator this year.

Orchard Lectures and Demonstrations.—The usual departmental practice of giving lectures on orchard pests and diseases, also practical demonstrations in pruning, spraying, &c., has been continued during the past winter. A total of 158 of such lectures and demonstrations was given by the field officers of the Horticulture Division during the months of June, July, and August in their respective districts, the attendance in most instances being very satisfactory.

TOMATO VARIETY TEST AT NELSON.

W. C. HYDE, Orchard Instructor, Nelson.

DURING the season 1920–21 a variety test of tomatoes was carried out by the Horticulture Division in co-operation with the Nelson Tomato-growers' Association, in the gardens of Mr. L. M. Estcourt, Grove Street, Nelson.

Seeds of different varieties were received from various sources as follows: Hallewell Seed Company, San Francisco: Stone, San Jose Canner, Trophy. Bay Counties Seed Company, San Francisco: New Stone, Spark's Earliana. Avonhead Training-farm, Christchurch: Sunny Jim. Te Aro Seed Company, Wellington: Early Dawn, Main Crop, Dwarf Champion, Marvel of the Market, Acme, Chemin, Trophy, Fillbasket, Chalk's Early Jewel. Tauranga Horticultural Station: Water Baby, Farnham Recruit. Arataki Horticultural Station: Dreadnought, Selected Kidson. Other varieties included in the test were Earliana (Gibbons), Buck's Tresco, Selected Dwarf Red, Parker, Parker's Outside, Unnamed No. 20, Unnamed No. 21, Unnamed H.B., local Main Crop. The total was twenty-eight varieties.

All the plants were planted in the open adjoining the main crop in the gardens, and received similar treatment to the main crop. Usually there were twelve plants of each variety.

The plants were inspected on 6th October by the writer in company with Mr. Estcourt. Observations then made are given in the following notes:—

Dwarf Champion were sturdy plants, only one-third the height of ordinary plants of the same age. Early Dawn had germinated poorly; only two strong plants were saved. Marvel of the Market were very fine plants. Acme, Trophy, and Chemin were good average plants. The seed of these varieties was from the Te Aro Seed Company, and was sown on 4th August. The average height of the plants at the time of this inspection was 6 in.

Trophy (California) plants were similar to the preceding of the same name. The germination of Stone was very bad; only two plants were saved, one of them being a strong plant. San Jose Canner were good plants, rather more dwarf than usual. New Stone were good strong plants, looking very well. Spark's Earliana were showing bloom-buds very distinctly; good plants; they were from seed obtained by Mr. J. A. Campbell. Earliana (Gibbons) was similar to the preceding. Selected Kidson had been a little too long in the seedling-box. All these varieties had been sown on 4th August.

Buck's Tresco were good big plants similar to Large Red. Selected Dwarf Red, less divided than usual; some bloom-buds showing. Sunny Jim, sturdy plants, ahead of Main Crop. All sown on 11th August.

good plants, one-half the ordinary height. Main crop, good plants with leaves

Parker were fair plants. Parker's Outside, sturdier plants than the preceding. Unnamed No. 20 and Unnamed No. 21, good average plants. All sown on 18th August.

The following were sown on 15th September and were not pricked out at the time of inspection: Water Baby, Farnham Recruit, and Chalk's Early Jewel. The germination was good, and they were making good growth.

Unnamed H.B. were good plants, checked a little in hardening off. Fill-basket, good plants. These had been sown on 14th July with the main crop. Kidson (local main crop), sown 14th July, was now just about established in the open, 6 in. to 7 in. high.

On 23rd December the test plot was again inspected, and the following notes taken :—

Dwarf Champion were one-half the average height ; foliage a dark-green colour and very much curled ; bottom bunch small and on some plants missing ; a small second bunch showing. Early Dawn, equal to main crop, good bottom bunches. Marvel of the Market, very fine plants, but with little or no fruit. Acme, strong plants ; rather mixed types, little or no fruit ; no bottom bunches. Trophy, a poor setting of fruit ; fruit-sprays a long raceme. Chemin, a fine plant with a good setting of fruit.

Trophy (California), fair plants, with little or no fruit. Stone, a very nice plant, holding a good compact bottom bunch of fruit ; good blossom. San Jose Canner, strong plants, carrying a fair setting of small round fruits. New Stone, very strong plants, but not quite the crop of Stone. Spark's Earliana, tall plants with long sprays of blossom ; a poor setting of fruit.

Buck's Tresco, carrying a good compact bottom bunch of big wrinkled fruit ; worth another trial. Selected Dwarf Red, plants one-half the average height ; a wonderful bottom bunch of fruit. Main Crop, sturdy plants carrying a big crop. Sunny Jim, good plants, similar in type to Market King variety.

Parker, strong elegant plant ; fruit small and round. Parker's Outside, good plants with moderate crop. Unnamed No. 20, rather dwarf plants ; little fruit ; no merit. Unnamed No. 21, good plants, with a moderate crop in nice compact bunches.

Water Baby, neat plants ; owing to late planting they were still small ; nice sprays of blossom showing. Farnham Recruit, still only young plants, but very promising ; a nice-shaped bottom bunch setting well. Chalk's Early Jewel, young plants, just setting the bottom bunch

Unnamed H.B., close, curly, dark foliage ; round fruit on a nice spray ; good. Fillbasket, sturdy plants, with a compact bottom bunch of fruit ; second and third bunch of blossom showing.

On 7th February, when the tomato season was at its height, the plot was again carefully inspected, the following observations being made :—

Dwarf Champion, set poorly, the fruit being flattish and inclined to be wrinkled ; nice and fleshy, but late. Early Dawn, fruit set well, but was small, round, and seedy ; rather late ripening. Marvel of the Market, bunches medium-sized, set well, with good roundish fair-sized fleshy fruit ; ripening earlier than preceding. Acme, good, round, fleshy fruit, but a poor setting ; did not seem to be a good strain. Trophy, fruit rather round, large, firm and fleshy. Chemin a compact bunch, well set ; fruit oval, flattish, rather good and uniform.

Trophy (California), rather better strain than the preceding of same name. Stone, short compact bunches, well set with wrinkled, seedy fruits. San Jose Canner, a spreading bunch of very fine, smooth, oval, fleshy fruit, but the crop was poor. New Stone, too variable ; no outstanding merit. Spark's Earliana, long spreading bunch of wrinkled fruit ; nothing to recommend it. Earliana (Gibbons), similar to the preceding, but set rather better. Selected Kidson, for the second time this strain has justified itself ; it deserves a larger trial.

Buck's Tresco ; Some who saw these plants stated the variety was not true to name ; it carried five compact bunches of fruit on less than 4 ft. of vine ; set well with wrinkled, fleshy fruit ; a very good variety. Selected Dwarf Red, a great first bunch, with nothing to follow. Main Crop, fruit wrinkled, flattish, and rather hollow ; badly affected with "black stripe." Sunny Jim, big bunch of rather small fruit, smooth and round.

Parker, long racemes of round fruit, set well ; worth a trial under glass. Parker's Outside, strain seemed rather variable ; should be given a further trial. Unnamed No. 20, excellent oval, smooth fruit, but only a moderate set. Unnamed No. 21, slightly wrinkled fruit, good and fleshy inside ; a fine type, should be tried again.

Water Baby, smooth round fruit of even size, and fleshy ; certainly worth another trial. Farnham Recruit, long sprays, well set, with smooth, round, even-sized, well-fleshed fruit ; certainly worth another trial. Chalk's Early Jewel, a straggling bunch, poorly set, with flat, slightly wrinkled, round fruit of excellent quality.

Unnamed H.B., rather variable ; best type round and smooth, fleshy and well-sized fruit ; worth another trial inside and out. Fillbasket, smooth, slightly wrinkled, oval, fleshy, uniform-sized fruit ; a very fair plant.

The foregoing are descriptions of the plants as they grew under commercial conditions on the trial plots last season. Chalk's Early Jewel and Fillbasket were grown on the trial plots the season before last with similar results. It will be seen that some of the varieties are worthy of further consideration—for example, Marvel of the Market, Chemin, Trophy (Californian strain), Selected Kidson, Buck's Tresco, Sunny Jim, Parker, Parker's Outside, Unnamed No. 21, Water Baby, Farnham Recruit, Unnamed H.B. (Hawke's Bay). It is desirable to sow these at the same time as the main local crop, giving them similar treatment, and to carefully make further comparisons. Parker and Unnamed H.B. should be given a trial under glass.

During the season such a bad attack of "black stripe" was experienced among the test plants that it seemed to indicate the possibility of infection having been introduced on the new seed. Previously this disease had occurred very little in Mr. Estcourt's gardens, and such an outbreak was very unexpected. It is possible that the bacteria were preserved in the dried fruit-pulp adhering to the seeds, and suggests the need of treating doubtful samples of seed before planting.

FARMERS' FIELD COMPETITIONS.

CROP DATA IN THE TARANAKI–WANGANUI DISTRICTS.

J. W. DEEM, Fields Instructor, Wanganui.

In the *Journal* for August, 1920, the writer gave some current notes on farmers' field competitions in Taranaki, and pointed out that the movement was extending. This season thirty-five competitions, at twelve centres, were held in my district, comprising localities between New Plymouth and Palmerston North. Of this number, thirty were judged by Instructors Glasson, Schwass, and myself. The numbers and the varieties of crops were as follows: Mangolds, 84; swedes, 77; carrots, 34; soft turnips, 14; lucerne, 10; and maize, 8: total, 227.

In most cases good numbers of farmers turned out to accompany the judges and see the crops. By so doing they were enabled to intelligently discuss the merits and demerits of the crops judged. This phase of the work is of great educative value. The great benefit to be derived from the competitors accompanying the judges from farm to farm cannot be too strongly emphasized, and unless they are prepared to do this it is hardly worth while starting competitions. Farmers' social meetings for the distribution of prizes provide a further opportunity of bringing the judges and farmers together and discussing the points brought out by the competitions.

The work promises to further extend this season, and already several other centres have signified their intention of starting competitions.

These competitions have provided a considerable amount of reliable data as to what may be expected under fairly good farm practice, and some of the points brought out should be of general interest. The results here given are worked out from the competitions in Taranaki and as far south as Wanganui during the last three years.

SOFT TURNIPS.

Soft turnips are grown in Taranaki for feeding to dairy cows from January to April, and are usually sown from the end of October to the middle of December. The winning crops in the competitions were all sown between 7th and 20th November.

The heaviest crop was 40 tons 11 cwt. and the poorest 23 tons 16 cwt., the average of 29 crops weighed being 32 tons 14 cwt. Of the main varieties grown, 14 crops of Hardy Green Globe averaged 32 tons 1 cwt., 9 Purple-top Mammoth, 32 tons 6 cwt., and 2 Imperial Green Globe, 34 tons 15 cwt.

The placed crops were mostly sown with 10 oz. to 14 oz. of seed through every second coulter of the drill, with 3 cwt. of manure per acre. The latter consisted of mixtures of slag and superphosphate, Ephos phosphate and super, or basic super, it being generally recognized that a fairly quick-acting manure is required for soft turnips.

SWEDES.

A census of 141 swede crops judged in the competitions during the period under review furnishes the following particulars: 82 crops of Superlative gave an average of 37 tons 12 cwt. per acre; 27 Magnum

JUDGING A SWEDE CROP IN THE OTAKEHO FIELD COMPETITION.

Bonum, 39 tons 3 cwt.; 7 Monarch, 36 tons 12 cwt.; 6 Crimson King, 35 tons 6 cwt.; 6 Champion, 33 tons 8 cwt.; 4 Masterpiece, 36 tons 16 cwt.; 4 Up-to-Date, 32 tons 11 cwt.; 3 Grandmaster, 40 tons 9 cwt.; and 2 Caledonian, 39 tons 7 cwt. The whole 141 crops averaged 36 tons 19 cwt. per acre. The heaviest crop was 57 tons 4 cwt., and the four heaviest averaged 55 tons 18½ cwt. All of these were Superlative.

Taking the placed crops in eight competitions it is found that 5 firsts, 4 seconds, and 5 thirds were grown in 14 in. drills; 3 firsts, 4 seconds, and 3 thirds in 7 in. drills. None of the crops were sown in wide drills to allow of intercultivation.

Dealing with the same eight competitions it is found that the placed growers used manure in the following quantities: 6 firsts, 5 seconds, and 3 thirds, 3 cwt. per acre; 1 first, 2 seconds, and 1 third, 4 cwt. per

acre; 1 first, 2 thirds, 2 cwt. per acre; 1 second, 3½ cwt. per acre; 1 third, 2½ cwt. per acre; and 1 third, 4½ cwt. per acre. In no case did any one kind of manure win two competitions. The places were filled by various combinations or proprietary mixtures, emphasizing the fact that most of the phosphatic mixtures on the market will give good returns if they are assisted by proper cultivation.

With the same crops it is found that the rate of seeding also shares a considerable variation in the rate per acre, as follows: 12 oz. per acre, 3 firsts, 1 second, and 2 thirds; 14 oz., 2 firsts; 16 oz., 1 first and 2 thirds; 11 oz., 1 first and 1 third; 10 oz., 1 first, 1 second, and 2 thirds; 9 oz., 3 seconds and 1 third; 13 oz., 1 second; and 8 oz., 2 seconds.

MANGOLDS.

The mangold crop is coming more to the fore, being free from the attacks of aphis, moth, and club-root, and a great deal more reliable than swedes. The return per acre is also much better; 144 crops weighed in the competitions averaged 49 tons 1⅔ cwt., the heaviest crop (Prizewinner) weighing 84 tons 4 cwt., and the lightest (Long Red) 26 tons 18 cwt. The varieties work out as follows: 53 crops Prizewinner, average 50 tons 12 cwt.; 36 crops Jersey Queen, 47 tons 1 cwt.; 30 crops Long Red, 46 tons 8 cwt.; 15 crops White Sugar, 52 tons 12 cwt.; 5 crops Large Yellow Globe, 50 tons 15 cwt.; 4 crops Smithfield, 49 tons 7 cwt.; and 1 crop Yellow Champion, 53 tons.

Summarizing the placed crops in ten of these competitions the following particulars are brought out: Prizewinner gained 4 firsts, 7 seconds, and 3 thirds; mixture of two or more varieties, 5 firsts, 1 second, and 4 thirds; Jersey Queen, 1 first, 1 second, and 1 third; Long Red, 2 thirds; and White Sugar, 1 second. It should also be noted that in the mixed crops Prizewinner predominated.

Results in relation to method of sowing were as follows: Sown in 28 in. drills, 5 firsts, 4 seconds, and 5 thirds; 21 in. drills, 4 firsts, 3 seconds, and 1 third; 14 in. drills, 3 seconds and 1 third. This is interesting as showing that the wide drills, which allow of horse-work, give better returns than the close 14 in. drill, with which the work has to be done by hand.

As with the swedes, no one manure or combination of manures appears to stand out. One strong point was the effect of salt in the thirty placed crops. This had been applied at from 2 cwt. to 5 cwt. per acre in the case of 6 firsts, 5 seconds, and 4 thirds. The heaviest crop, 84 tons 4 cwt., was grown with 3 cwt. basic super and 2 cwt. salt; the next, 83 tons, with 2½ cwt. super, 5 tons cow-manure, and 2 cwt. salt; and the third, 67 tons 16 cwt. with 3 cwt. super. 1 cwt. bone, 1 cwt. Ephos, and ½ cwt. salt per acre. It should be noted that little or no kainit has been available during the last few seasons, hence the necessity for using salt.

CARROTS.

Carrots are not grown to anything like the extent they should be, having regard to the fact that the crop is one of the surest to grow and safest to feed of all root crops. However, the yields as shown in the competitions are causing farmers to give this crop more consideration, and there are indications that the area will be greatly extended. Sixty-two crops weighed gave an average of 31 tons 11 cwt. per acre,

the main varieties giving the following yields: 22 crops Matchless White, 34 tons 16 cwt.; 20 crops Sinclair's Champion, 29 tons 11 cwt.; 7 crops Magnum Bonum, 33 tons 4 cwt.; 5 crops White Belgian, 28 tons 9 cwt.

In eight competitions Matchless White won 3 firsts, 3 seconds, and 3 thirds; Sinclair's Champion, 2 firsts, 2 seconds, and 2 thirds; mixtures of Matchless White and Sinclair's Champion, 2 firsts, 1 second, and 3 thirds; Long Red and Intermediate, 2 seconds; and Matchless White and Intermediate, 1 first.

All the winning crops were seeded at from 1 lb. to 1½ lb. per acre. The majority were sown in 14 in. drills, and for this reason it will not be surprising when it is recorded that the 14 in. drills gained 7 firsts, 6 seconds, and 6 thirds; 21 in. drills, 2 seconds; and 28 in. drills, 1 first and 2 thirds. It is interesting to note that the heaviest crop in all the carrot competitions—namely, 46 tons 17 cwt.—was Sinclair's Champion, grown in 28 in. drills. As with the swedes and mangolds, no special manure stands out; apparently any reliable manure at from 2 cwt. to 3 cwt. per acre will give good results.

LUCERNE.

The lucerne competitions so far have been confined to the Otakeho district. This year two competitions were held, one for first-year crops and one for crops one year old and over. It is interesting to note that Mr. E. Burke's crops, which won last year with 35 points out of a possible 40, came first again this year with 37 points. This stand is now five years old, and a very fine one. The second place was filled by a crop that was so poor last year as not to be worth judging. As the result of last year's competition it was given a good clean-up and top-dressed with 3 cwt. of blood-and-bone. This year it was a picture, gaining 35 points. The winning crop was top-dressed last spring with 4 cwt. of superphosphate. The appearance and returns from these two crops gave a very definite reply to those who do not believe in top-dressing lucerne.

GENERAL.

The strongest feature in these competitions generally is the way in which they have shown the benefits to be derived from early ploughing and thorough cultivation. Specially is this the case with the mangold and carrot crops. With these crops after-cultivation has proved of far more importance than manure. In some instances competitors have increased their manure and given less cultivation, with the result that their crops have been very indifferent.

Turnip-manuring.—The manure used at the Stratford Model Dairy Farm during the past four years for the main turnip crop was basic superphosphate at the rate of 3 cwt. per acre, and the crops have averaged 45 tons 8 cwt. during the whole period. At the Waimate West Demonstration Area, Egyptian basic phosphate (Ephos) and super (half and half) have been used for the last two seasons, the average crop being 43 tons 19 cwt. per acre.

WORK FOR THE COMING MONTH.

THE ORCHARD.

THE FIREBLIGHT CAMPAIGN.

ANXIETY among fruitgrowers regarding the possible spread of the ravages of fireblight is naturally on the increase as the season advances. While the controversy regarding the destruction of hawthorn—or, at least, the declaration of this plant as a noxious weed by the local authorities—is still being carried on in such districts as Nelson, Hawke's Bay, &c., the growers in the vicinity of Auckland, having the disease at their door, have got past this stage, and are now settling down to a definite plan of campaign designed to protect their orchards to the maximum extent possible against the immediate effects of the actual disease itself.

The Director-General of the Department (Dr. Reakes) visited Auckland recently, and went into the whole question of the coming season's work with the Central Fireblight Committee. A satisfactory working-scheme was devised. The committee is undertaking the work of the complete eradication of hawthorn in all cases where the consent of the owner can be secured, and will otherwise co-operate with the officers of the Department. The latter will enforce the provisions of the Noxious Weeds Act, which applies in the Waitemata County relative to hawthorn, and will also attend to the inspection of orchards affected with fireblight for the purpose of insisting on all affected parts being immediately removed and destroyed. Each grower is advised to attend to this work in his own interests, and to see that all his neighbours do likewise. This is a case in which every one interested must help. One neglected orchard or even tree will be enough to reinfect the district the following season; and, seeing that it is the fruitgrower who will suffer, it is for fruitgrowers to assist the Department's officers in seeing that no neglected orchards or trees are left long unattended to in their particular localities.

In order to ensure the earliest discovery of any possible occurrence of fireblight outside the present infected district, growers are requested to bring under the notice of their district Orchard Instructor any suspicious symptoms, such as dead tips, blossom-clusters, and cankers on apples, pears, quinces, and hawthorn.

FRUIT-EXPORT MATTERS.

Mr. G. Stratford has arrived back from England this month. He is in a position to impart a fund of valuable information on matters relative to the export of fruit, and arrangements are being made for him to visit and address associations in districts directly interested in export. Subsequently the committee appointed by the recent Fruitgrowers' Federation conference to meet the Department on the question of the export regulations will be invited to Wellington, with a view to making any amendments to the regulations which Mr. Stratford's experiences may suggest.

—J. A. Campbell, Director of the Horticulture Division.

AUCKLAND.

Spraying pip-fruits: It is necessary to closely watch opportunity throughout this month to apply the first bud-movement spray, bordeaux 8–6–40, for control of fungoid troubles. This must be followed by bordeaux, 6–4–50, at the cluster-bud stage, and again later with bordeaux, 3–4–40, with the first arsenate (calyx) spray for codlin-moth—one of the most important operations in the annual programme of growers of pip-fruits. For successfully carrying out this work a high pressure is needed to force the poison well into the calyx-cup. This application is carried out immediately the bloom-petals have fallen and while the calyx yet remains open.

Spraying stone-fruits: The early spring application will now have been completed. It is desirable in cases where brown-rot has been prevalent that an application of bordeaux, 3–4–40, or commercial lime-sulphur, 1–120, should be got on just at the time when three-fourths of the blossom-petals have fallen. The bordeaux is only recommended as a spray just at this period, and must be applied

immediately at the time stated or not at all. Judicious thinning of stone-fruits is recommended as essential in materially lessening brown-rot.

Cultivation: It is imperative that the plough be got to work at the earliest opportunity. The heavy growth of Lotus angustissimus experienced annually in orchards in the northern districts makes this essential, and should the spring prove to be dry the work is only accomplished with difficulty.

Citrus fruits: Owing to the irregularity in the growth and consequently in the blossoming of citrus-trees (especially lemons this year) growers must judge individual cases, and put on their bordeaux, 5–4–40, when the spring growth has hardened, or 4–4–40 if the fruit has set before the growth hardens off. The abnormally cold weather, with many heavy frosts, has caused much damage to citrus-trees, more especially lemons, where no covering was afforded. Attention should be paid to all affected trees, and all frosted parts cut away to a bud or lateral growth. This work is important, as dead wood resulting from neglect to carry it out will afford abundant opportunity for the entry of borer.

Strawberries: Growers are advised to spray with bordeaux, 4–4–40, keeping the foliage covered, for control of leaf-spot.

—J. W. Collard, Orchard Instructor, Auckland.

HAWKE'S BAY.

Spraying will be the chief work of the month. Apples and pears should be watched and sprays for black-spot applied as the trees attain the open-cluster stage. Bordeaux, 6–4–50, is the spray to be used, followed by bordeaux, 3–4–40, at fruit-set on varieties which are subject to bad black-spot. Varieties which are known to russet should receive lime-sulphur, 1–50, at the later stage instead of bordeaux; while those which are not generally infected with black-spot may have lime-sulphur substituted in both instances at 1–25 and 1–50 respectively, with the addition of 6 lb. atomic sulphur per 100 gallons where mildew is expected. Later spraying when the young fruit has formed will consist of arsenate of lead (1½ lb. of paste or 1 lb. of powder to 50 gallons of water), plus ½ gallon of lime-sulphur, together with the milk made from 1½ lb. of fresh-slaked lime. For peaches, nectarines, and Japanese plums an application of lime-sulphur, 1–120, will be advisable soon after fruit-set for control of brown-rot. European plums should receive bordeaux, 6–4–50, at cluster-bud stage for rust.

Cultivation: With the limited rainfall experienced this season it will be advisable to work the land down to a fine tilth as early as possible.

Fireblight: A keen lookout should be kept for any suspicious circumstance which might indicate that this disease is present. All dead tips, twigs, spurs, or blossom-clusters, eruptions of the bark, or cankers on apple, pear, quince, medlar, or hawthorn should be regarded with suspicion. Communicate at once with the Orchard Instructor, who will have specimens examined and advise what steps are necessary to deal with the trouble.

—W. H. Rice, Orchard Instructor, Hastings.

NELSON.

During the early days of October the apple-trees commence to blossom, and as they show colour it is necessary to spray them with lime-sulphur at 1–50. Varieties difficult to keep clean are usually sprayed with bordeaux instead. Pear-trees will soon afterwards have set their fruit, when bordeaux, 3–4–40, should be applied; to this spray it is advisable to add arsenate-of-lead paste, 3 lb. to 100 gallons, or half that weight of arsenate-of-lead powder. Towards the end of the month, as the apple-trees set their fruit, lime-sulphur, 1–100, plus 3 lb. of arsenate-of-lead paste, is applied. Stone-fruits, too, are given somewhat similar attention as soon as the calyx-parts fall. In their case the lime-sulphur had best be applied alone at a strength of 1–120.

At this season the land should be in good clean tilth again, the heavy-bearing sections having a good dressing of manure. If this has not yet been completed care must be taken when doing so to avoid ploughing too deep.

This is the season for grafting over trees which it has been decided to rework. There are far too many failures in this work, some of the more frequent being due to making the grafts too long, using poor unripened wood, want of thorough waxing, or disturbing the grafts when cultivating. As it is by no means easy to establish an apple-tree on the spot where one has grown before, a good stock is of great value, and every effort should be made to get a good "take." See that the buds are arranged so as to make a shapely tree.

—W. C. Hyde, Orchard Instructor, Nelson.

NELSON CENTRAL.

Spraying operations: Last month's notes dealt with spraying for control of black-spot up to the petal-fall and fruit-set stages, at which time lime-sulphur, 1–60 to 1–80, was recommended. A few further remarks may be of assistance to growers who are undecided as to procedure. At fruit-set and subsequent applications spray-damage has sometimes occurred. To guard against this add to each 50 gallons of spray the milk of lime obtained from about 2 lb. of quicklime. Atomic sulphur, 3 lb. to each gallon of concentrated lime-sulphur used, has also given good results in cases that have come under my notice, and is well worth a trial. For the application prior to calyx-closing lime-sulphur should be diluted to 1–100, and discretion used as to the addition of arsenate of lead. If no trouble has been experienced the previous season with codlin-moth, to my mind the addition of arsenate of lead is superfluous, but Black Leaf 40 should be added if woolly aphis is showing up: it pays to catch the first colonies. Also paint over the badly infected and knotty trunks and limbs with strong oil emulsion. Where large cuts have been made for grafting, paint over with good white-lead paint, as neglect of this means greater chance of silver-blight infection.

—*J. H. Thorp, Orchard Instructor, Mapua.*

MOTUEKA.

Cultivation should not be neglected during the coming month. Keep the soil in good tilth to maintain vigour in the trees; trees in good heart are better able to withstand disease.

Spraying-measures recommended for the month are: Stone-fruits—Lime-sulphur, 1–125, to prevent brown-rot. Apples—Lime-sulphur, 1–100, to which should be added arsenate of lead, 3 lb. paste or 1½ lb. powder per 100 gallons, at fall of petal. Lime-sulphur should be applied regularly after the first application at intervals of about ten days, arsenate of lead being added at each alternate application. The addition of 3 lb. or 4 lb. of atomic sulphur to each gallon of lime-sulphur used has been recommended to prevent "spray-burning." Constant applications throughout the season as recommended will not only ward off black-spot and powdery mildew, but will also deal effectively with red mite and leaf-hopper, both of which caused considerable damage to the foliage last season. The addition of Black Leaf 40, 1–1,000, will be found beneficial where the latter pest abounds. Pears—Bordeaux, 3–4–40, with arsenate of lead as above, at fall of petal.

—*W. T. Goodwin, Orchard Instructor, Motueka.*

CANTERBURY.

Grafting and budding: If done at once, it is not too late to head back and regraft old trees with more suitable varieties. Keep all the stocks worked last season well disbudded, and do not allow suckers to grow. If stocks where buds were inserted have not been cut back, this should be done at once to encourage a straight trunk.

Cultivation and manures: See that the orchard is in good tilth, as the crop largely depends on the condition in which the soil and trees are kept during the early summer. Under no circumstances should cultivation be neglected. It is not too late to apply nitrogenous and phosphatic manures. Read what last month's notes say in regard to this matter.

Spraying: It is now too late to apply sprays at winter strength, which must always be used before the trees burst into leaf and blossom. Stone-fruits—For red mite, leaf-curl, brown-rot, and rust, lime-sulphur, 1–125, is recommended. If peach-aphis appears spray with lime-sulphur, 1–125, or with Black Leaf 40, 1–1,000, plus 3 lb. Sunlight soap per 100 gallons. Pip-fruits—For black-spot apply lime-sulphur, 1–100. Powdery mildew is likely to be prevalent again this season; an application of sulphur atoms, 1 lb. to 9 gallons, or atomic sulphur, 1 lb. to 10 gallons, will be found effective. Twigs infected with powdery mildew should be cut off and burnt. For codlin-moth apply calyx-spray, using arsenate of lead at a strength of 3 lb. paste or 1½ lb. powder to 100 gallons. When the arsenate of lead is mixed with lime-sulphur, the addition of the milk of lime from 3 lb. or 4 lb. of quicklime to the former before mixing will assist in neutralizing the free acid in the mixture and lessen the danger from burning. Watch the trees carefully for the hatching of red-mite eggs, and spray at intervals of ten days with lime-sulphur, 1–100. Lime-sulphur, particularly stocks left over from last year, should be tested with a Beaume hydrometer to find the specific gravity, and diluted according to table, copies of which may be had on application. When

corking up the lime-sulphur tin after a portion has been drawn off the application of a little grease round the cork will prevent air from subsequently getting into the tin. —*W. K. Dallas, Orchard Instructor, Christchurch.*

OTAGO.

For the treatment of black-spot bordeaux is the preventive to be relied on, and must be applied at the correct stage. Though there are certain varieties which russet badly if bordeaux is applied too late, all varieties will benefit by an application at tight-cluster, at a strength of 6–4–50, to be followed up by lime-sulphur, 1–30, or atomic sulphur, 4 lb. to 40 gallons, at open-cluster stage. Lime-sulphur will be found beneficial for prevention of powdery mildew as well as black-spot.

The strength of lime-sulphur recommended for the period after the blossom falls is 1–100 at 32° Beaume test. This will be found to act as an insecticide as well as fungicide, especially in controlling red mite. Once this insect becomes active a thorough spraying of the trees at this strength should prove effective, and similar applications should be made at frequent intervals (say, every eight or ten days) in order to catch delayed hatchings.

—*B. G. Goodwin, Orchard Instructor, Dunedin.*

POULTRY-KEEPING.

F. C. BROWN, Chief Poultry Instructor.

THOSE who have managed well will have the last of the hen-eggs for the season undergoing the incubation process by the end of September at the latest. Of course, some people will continue to hatch out chickens for many weeks to come, but in most cases these will prove undesirable stock from all viewpoints. A chicken brought out, say, later than the middle of October is starting its life under a big handicap as compared with the bird hatched earlier in the season. In the first place, the parent stock are not in the same vigorous condition as formerly; secondly, the rearing-quarters, and especially the run, will be in a more or less stale condition; and, thirdly, the chickens are being called upon to develop during hot trying summer weather. Again, the young birds will have to endure the cold autumn snaps that are likely to be experienced before they have attained a matured stage. It must be ever remembered that the most profitable stock are those which commence to develop as the days are lengthening rather than when they are on the wane. Of course, some amends may be made with late-hatched chickens if they are placed under the most ideal conditions possible. In this connection not only should they be provided with an absolutely clean piece of ground to run on, but good shade and shelter must not be overlooked. In addition the food-supplies should be of a most nourishing nature, and on no account should an abundant supply of green-stuff be forgotten.

TRANSITION FROM THE BROODER STAGE.

Considerable judgment is necessary, especially at this period of the year, in connection with transferring the chickens from the brooder to the colony-house. When possible this should be done when favourable weather conditions prevail. Every care should be taken to carry out the hardening-off process by degrees. Thus it is advisable that the colony-house quarters be arranged in such a way that they are similar in every respect to those from which the young birds have been drafted. The desired warmth and seclusion should be available, but an abundance of fresh air should be provided as well. Some people turn the chickens into a colony-house after leaving the brooder, and make no special provision whatever for the chickens to sleep in comfort. This means that the chickens, feeling the great change of conditions they are being subjected to, will seek for these, with a result that they will be found huddling on the top of each other in a corner, probably under the dropping-board. In such cases it is not uncommon to find in the morning numbers dead, to say nothing of the sweated condition of the others, which leaves them susceptible to every passing ailment and with probably a set-back for life. It is safe to say that thousands of chickens are lost annually through huddling in corners as a result of being moved from the brooder to an unsuitable colony-house.

There are many ways of avoiding trouble in this respect. A simple method is to first remove the dropping-boards and perches (which, of course, should be always removable if vermin are to be kept in check). The dropping-boards may be dispensed with for the time being, but the perches, three or four in number, should be arranged, say, 1 ft. from the ground and sufficient distance apart to allow a sack to cover them and to almost touch the bedding-material (straw, &c.) on each side, a temporary hover thus being formed. The back perch should be not more or less than 3 in. or 4 in. from the back wall. With a little care and attention given in this way for the first night or two the chickens are able to secure the desired seclusion, while, the ends of the covering being open, fresh air is available to them at all times. The number of sacks to be used depends on the number of chickens to be provided for. It is better, however, to have the sacks on the long side rather than on the short.

As a general rule, not more than one hundred chickens should be placed together—at any rate, not until they have learned to perch. As an inducement for the chickens to acquire the habit of perching when undergoing the hardening process during the brooder stage it is a good plan to have a few perches in the inside brooder-runs, a few inches above the floor. It is surprising how soon the chickens will take to these, all of which tends to early perching. As a further means to this end a few low perches may also be arranged under the perches and sacks in the colony-house. It is generally considered—and rightly too—that once a chicken commences to perch it has practically passed the most dangerous period of its growing-stage. In a colony-house it is always advisable to have the corners rounded off with wire netting, so that in the event of crowding fresh air may be available to the chickens from the back.

The desired seclusion and an abundance of fresh air are among the chief essentials for the welfare of chickens after leaving the brooder. Neglect of fresh air causes a very large mortality even with chickens up to six or seven weeks old. The most common trouble in this respect is an inflammation of the veins, followed by discoloration of the hock-joints and under the wings. Later the head and neck swell, and death soon follows. When once chickens become affected in this manner it is a sure indication that they are sleeping in a moist atmosphere, owing to improper conditions being provided. There is no cure for this trouble; prevention is the one and only way of dealing with it, and the secret of prevention is not to overcrowd, but to provide plenty of ventilation, keep the quarters clean, and check anything that is apt to cause a moist atmosphere, such as damp bedding, &c.

A fresh run for chickens after they leave the brooder should be provided wherever it is possible to do so. Clean ground is one of the chief secrets in rearing any class of live-stock, but this specially applies to the artificially raised chicken.

CROOKED BREAST-BONE.

It is now generally considered that allowing chickens to roost at too early an age is the chief cause of deformed breast-bone. While this may be true in one sense it is not in another. For instance, if very narrow perches are provided when early roosting is allowed a large proportion of bent breast-bones will be the result. On the other hand, if broad perches of, say, not less than 3 in. in width are used the number of birds affected with this trouble will be reduced to a minimum. After all, a slight bend in the breast-bone does not necessarily condemn a bird for breeding purposes, as is too often thought, especially where every other joint in the bird's make-up is a signpost of constitutional vigour. True, a deformed breast spoils the appearance of a dressed table bird, and for this reason alone it should be avoided. Apart from early perching and where an unsuitable perch is provided, there are other causes of deformed breast-bone, such as allowing the birds to sleep on a hard floor of concrete, wood, &c. Before the chickens take to the perches they should therefore be provided with a good thick bed of straw or similar material to sleep on.

Breeding from delicate stock, and especially from fine-boned birds, may be responsible for this trouble. The observant breeder, however, would see that such stock never entered one of his breeding-pens. A few days ago, discussing the causes of crooked breast-bone with a most successful breeder, and one who pins his faith on having his male birds possessed of a maximum of constitutional vigour, he informed me that in order to promote this vigour he practically allowed his best selected young males to run in the bush in a more or less wild state, and that it was not uncommon to see them roosting near the tops of the highest trees. He admitted that the majority of the birds developed

crooked breasts, and mentioned that this did not trouble him in the slightest from a breeding viewpoint. He further remarked that as a general rule he did not fill orders with such birds, as it generally meant a complaint or the bird being returned on the assumption that it was constitutionally weak. Finally, he expressed the opinion that the condition of the breast gave little or no guide as to a bird's suitability for the breeding-pen, an opinion I myself have long held.

The framers of the new utility-poultry standards did not intend to disqualify a bird merely on this account, but rather to allow the judge to use his discretion as to the extent it should be taken into consideration. Unfortunately, however, in the description of the serious breed-defects for which a bird should be passed the words "any bodily deformity" would naturally be taken to apply to a crooked breast-bone as well as to such faults as a roached back, &c. Until the standards are revised the associations who control the shows would be well advised to let it be widely known at once that the "bodily deformity" referred to for which a specimen must be passed does not necessarily apply to a crooked breast. If this were done not only the judges but also the competitors would be in a position to know exactly where they stood on this vexed question.

THE APIARY.

F. A. JACOBSEN, Apiary Instructor.

EARLY SEASONAL WORK.

If the weather experienced during the weeks immediately past continues this coming season will be one of the earliest recorded for many years. The sunshine for the month of August and the early part of September has been well above the average, and this means that the stores left the previous autumn for winter and spring consumption are being used at a more rapid rate than usual. In consequence of this a careful watchfulness must be observed, particularly where natural spring forage is not abundant. Stocks with depleted stores or showing signs of general weakness should be strengthened either by the addition of frames of healthy brood and honey or by feeding a mixture of one-third A-grade sugar to two-thirds water. If this fluid is slightly warm it has a better stimulating effect.

Care must be taken not to feed openly, as this may start robbing by neighbouring colonies and thus curtail or eliminate the desired object. If a division-board feeder is not available a moderate-sized tin or glass jar with a finely perforated top may be used. When filled it is inverted and set directly over the top of the brood-frames. The syrup slowly drains through the perforations and is immediately sucked up by the bees. Various makes of feeders are on the market, the most popular for large quantities being the "Miller" and "Alexander," and for small quantities for stimulative feeding the "Simplicity" and the "Boardman."

Perhaps the best method of feeding a large number of stocks is as follows; it is simple and has the advantage that when once the food is supplied no more attention need be given, as in other cases, concerning the refilling of feeders or their removal: The syrup is mixed and poured into a small tank, which is placed at a considerable elevation. From the bottom of this tank a pipe is fixed—rubber for preference—and a rose with a cut-off tap attached. This arrangement is for the purpose of squirting the syrup into empty combs, and the height of the tank is necessary in order to obtain the pressure to eject the air from the cells. In this way several pounds of syrup can be supplied in each comb, which does away with the expense of feeders. A great amount of work can be got through in a very short time by this system, which makes it particularly advantageous to large apiarists.

The following precautions should be observed: (1) All entrances should be contracted if bees are inclined to rob; (2) care should be taken to avoid feeding sugar syrup showing the slightest sign of fermentation; (3) before using wooden feeders they should be waxed inside with a mixture of resin and paraffin.

Experienced beekeepers can judge in a moment by the weight of the hive, without opening it, whether the supply of food is running short or not, and every beekeeper should learn to do this. By putting one foot on the back of

the bottom-board to keep it steady, and with the hand raising the back of the hive, the weight can be got at once, and after a little practice one can judge to within a few pounds the amount of honey inside. In this way a large number of hives can be examined in a few minutes, and those needing food marked.

The safest and best food to give, unless frames of honey from known clean hives are available, is sugar syrup. Never purchase honey or accept it as a gift to feed your bees with. It is too risky, and to thoroughly sterilize it would require several hours' boiling, which causes more trouble than the honey is worth.

WATER-SUPPLY.

In the absence of a natural supply, water should be provided. Bees require a good amount of water for brood-rearing throughout the whole season, and it frequently happens that numbers of bees are lost if water is not near the hive. Moreover, bees often become a nuisance at cattle-troughs and by assembling around domestic supplies. Where a large number of colonies are kept it is imperative that the beekeeper should see the bees are well supplied. A good method is to keep a bath in the apiary partially filled with water in which is placed a number of sticks or brushwood. The bees alight on these and are thus prevented from drowning. Again, a kerosene-tin with a fair-sized hole punched in the bottom, through which a rag is drawn to regularly draw the water, and with a vessel beneath to catch the supply, is a good method to adopt.

POLLEN FOR BROOD-REARING.

Pollen is the fertilizing-dust of flowers, and bees gather it in large quantities. It is brought to the hive in the "baskets" provided for the purpose on the hind legs of the workers, and has a wide range of colours. It is made into bee-bread and fed to the larvæ, and is an essential food for brood-rearing. It frequently occurs that pollen is not available in sufficient quantities, particularly in early spring, and if a suitable substitute is not provided the colony is greatly handicapped in development. It was noticed by Hartlib as far back as 1655 that bees will gather fine sawdust, flour, and other similar substances to supplement the supply of pollen proper through a period of shortage. Later, Dzierzon noticed bees bringing rye-meal from a neighbouring mill before any natural supplies of pollen were available in the spring, and this substance is the one recommended down to the present time. It should be placed in shallow troughs in a sheltered place in the apiary.

VITICULTURE.

J. C. WOODFIN, Vine and Wine Instructor.

THE VINEHOUSE.

OUTSIDE borders should now be fairly warm, and, if dry, they can be first watered and then treated with liquid manure, covering the whole up with a mulch of stable manure, or, if this is not obtainable, with straw, to prevent the moisture evaporating.

A growing-temperature should be kept up in the vinery by means of careful ventilation, avoiding checks, which are frequently caused by opening the ventilators too wide when the outside air is cold, or opening them on all sides at once. As previously advised, the bottom ventilators should be kept closed.

Mealy-bugs have been exceptionally prevalent, and have caused considerable damage in some districts during the past season. If kept under at this period there should be little or no trouble from them when the grapes are ripe. Whenever one of these pests is seen it should be at once destroyed with a drop of methylated spirit. In cases where they are too numerous to be exterminated in this manner Black Leaf 40 will be found effectual, used as a spray at 1-800, which is equal to a little more than a teaspoonful to the gallon of water. Soft water should be used, and a teaspoonful of soap mixed with it will increase the effect of the nicotine. Soap, however, should not be used when Black Leaf is used in combination with other compounds.

CELLAR AND VINEYARD.

Young wines should be racked a second time before they begin to move. A slight fermentation is almost sure to set in, more especially in the white wines, as the weather grows warmer. Allowance should be made for this by keeping the bungs slightly loose, or replacing them with small bags of clean sand, or plugging the bung-holes with a piece of cotton-wool. The object is to keep out harmful bacteria and at the same time allow the extra carbonic-acid gas to escape, and so avoid the blowing-out of the bung or bursting of the container and subsequent loss of wine.

Occasionally it is considered desirable to rack wine which is undergoing a slight fermentation. To do this the wine can be pumped into a clean well-sulphured cask. The sulphuric acid taken up by the wine will cause the fermentation to cease, and the wine will become bright and clear, and can then be separated from the lees. Young wines should not be transported any distance at this time of the year, nor should they be bottled unless absolutely still, clear, and bright.

In the vineyard the second ploughing can be proceeded with for the purpose of breaking up and aerating the surface soil and preventing the growth of weeds. Deep cultivation is not advisable, on account of the liability of injury to the fibrous rootlets which in the moist climate of most parts of the Dominion grow near to the surface. The first ploughing in most districts should not be deeper than 6 in. and the second not deeper than 4 in.

The soil should not be worked when the vines are in bloom. The use of the plough at this period will result in the non-setting of the grapes. Nor should cultivation be proceeded with on low-lying land when frosts are expected, as disturbing the soil results in lowering the temperature near the surface and so favours the production of white frost.

THE GARDEN.

W. H. TAYLOR, Horticulturist.

VEGETABLE-CULTURE.

In vegetable-gardening the soil should, if possible, be prepared some time before it is to be sown or planted. This is more important when small seeds are to be sown, but the advice is good in every case, as the soil should have time to settle down before sowing takes place. In cases where a growth of weeds or a specially grown green crop has been worked in the soil may lie loose for some time, and in such condition does not make a good seed-bed. When the soil is loose it is not easy to prevent small seeds getting too deep, and this may cause losses. Again, in dry weather a loose surface soil loses moisture very quickly, and seeds may fail through the germ drying after germination, or they may not germinate at all. In connection with green manures, a circumstance that is not generally known is that during the process of decay this matter generates carbonic-acid gas, which is injurious to germinating seeds; failures are recorded from this cause. Further, this gas acts on the nitrogen-collecting bacteria, rendering them inactive, so that for a time a green crop may actually impoverish the soil and retard the growth of plants. This effect ceases, however, when decomposition is more or less complete; fertility is then restored and increased. It is therefore bad policy to sow or plant, more particularly to sow, soon after turning in any considerable amount of green matter.

Most artificial manures are not available to plants immediately they are applied to the soil. They have to undergo some change—brought about by soil-water—before they can be used by plants. When the soil is dry, as is often the case during the summer months, fertilizers may not become available to the crop they were intended for, owing to want of sufficient soil-water to effect the necessary changes and to dissolve the particles. Fertilizers should for this reason be applied early in the season while the soil is moist. They will then remain in the soil till taken up by plants, and there is very little danger of loss through their being washed from the soil. Some fertilizers that are commonly thought to be quick-acting are not really so. Blood manure is thought to act quickly, but is actually slow on account of the changes that must take place before it can be

used. Nitrate of soda is quick-acting and is also very soluble in water—in fact, heavy rain would soon wash it down beyond the reach of plant-roots. This salt is of great value to many crops—all those which require to make a good deal of green (vegetative) growth—and should be applied only to growing plants. The following is a good mixture for plants needing a fillip: 2 oz. superphosphate, 1 oz. sulphate of potash, and 2 oz. nitrate of soda, mixed in a kerosene-tinful of water and applied to every 4 square yards.

Tomatoes under Glass.

In some cases these are now in an advanced stage, depending on the time of starting, which again depends on the possession or otherwise of hot-water pipes. There is no doubt that a good deal of loss is caused by blights of various kinds. Very few will be prepared to admit that wrong treatment is the cause of blight, yet we have the statement in a bulletin of the International Institute of Agriculture that "there is no disease that is inherent in the tomato; all diseases that attack them are due to errors in treatment." A few years ago there were very heavy losses in glasshouses in different parts of the Dominion, and the Director of the Horticulture Division was called upon to have the trouble investigated. The result of the investigations which followed proved beyond doubt that the houses where the trouble occurred were kept in a condition of too much moisture. There has been a considerable improvement since that time, but still there is trouble. It should be understood that the tomato is a dry-weather plant. When the weather is dry and warm, with a fair but not excessive amount of soil-moisture present, there is little trouble with blights. A glass-house offers facilities for controlling the atmosphere, but it is the easiest thing possible to induce excessively moist conditions.

The necessity for securing a good crop induces the use of a liberal amount of fertilizers, including sulphate of ammonia. This fertilizer affects only the vegetative parts of a plant; it does not act on the fruit except in so far as good fruit ought to follow good growth. It is quite proper to use it, but it should always be accompanied by sulphate of potash, which directly affects the fruit and also makes growth firmer and less liable to blight.

I also am a firm believer in the advice of reliable authorities to the effect that no watering should be done in the latter part of the day, because it tends to create a moist atmosphere during the night, when the house should be as dry as possible. Such blights as can be controlled by spraying in the case of plants in the open ground can also be controlled by spraying plants under glass. Before spraying is done the house should be as dry as possible, and the operation should be carried out in the evening, leaving sufficient ventilation through the night to allow of the escape of moisture. In other countries, as well as in this, attention is being paid to soil-treatment for the control of blights. The following plan is being tried by a good many cultivators in England, and is claimed to be giving good results: When a fortnight old commence watering the plants every third day with a solution consisting of 1 oz. of sulphate of copper in 50 gallons of water. After six weeks' treatment increase the strength to 1 oz. in 35 gallons, applied every fourth day. Use rain-water if possible. The same treatment is applied to cucumbers.

Routine Work.

Tomato-plants intended for the open ground will now be on the way. The young plants should be sprayed with 4–4–40 bordeaux as soon as they begin to grow after being pricked off. The plan outlined above might well be tried; it will cost very little. Wherever it is convenient the boxes of plants should be placed on a mild hotbed immediately they are pricked off. Bottom heat has a wonderful effect in promoting root-growth, and if the plants are ventilated very freely as soon as they begin to grow fine plants will result.

Cabbages, cauliflowers, and lettuces should now be growing freely. If they appear to require hurrying give the liquid mixture of fertilizers mentioned earlier in these notes, or if that is not convenient, or if rainfall is plentiful, apply the same quantity of dry fertilizer direct to the soil and scratch it in.

Peas and French beans should be sown at regular intervals to maintain the supply—two weeks for peas and three weeks for beans. Runner beans should be sown early in October. Broad beans should be sown during October to succeed those sown during winter. The two sowings are sufficient for the year.

In the cooler districts sow main-crop carrots, parsnips, and red beet. In warmer districts these are not sown till early in November. The same remarks

apply to broccoli, but with regard to these I would say that in places where the cabbage-moth is troublesome safety may be found in starting early. It is useless to deny that when the attack is bad, which occurs only in very dry weather, young plants cannot be saved, the repeated attacks of the larvæ taking all the life out of young plants. If the plants are started early they will have made a good deal of growth before the moth is troublesome—at least, that has been my experience. In this case it is unnecessary to treat the outer leaves, but concentrate attention to the growing centre of the plant, for if this part can be saved growth will be continued. Treatment consists in dusting a little helebore powder in the hearts of the plants. It must be remembered that broccoli are not liable to premature bolting as are cauliflowers, so that an early start will not bring them in out of season, but will result, if the weather happens to be favourable, in extra-fine heads. Early kinds should be grown.

Brussels sprouts should now be sown, as they are at their best only when they have a long season of growth. In connection with this vegetable it may be stated that as it is the sprouts that are wanted a good many people think the leaves on the stem are useless and should be cut off. This is quite wrong; it is the leaves that cause the sprouts to form, and the latter would be very poor if the leaves were cut off. Turnips should be sown about seven weeks after the last sowing. Lettuce should be sown frequently in small lots, and radishes about every ten or twelve days. Sow leeks also.

Thin onions and all other seedling crops as soon as they can be handled—the earlier the better—and keep the soil clean and with a loose surface. Onions, when thinning is finished, should be given a dressing of nitrate of soda, ½ oz. per square yard.

Potatoes: The main crop should now be planted. Spray early crops with 4–4–40 bordeaux as a preventive of blight.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

TURNIPS AND REDWATER IN COWS.

"FARMER," Tahakopa, South Otago:—

Will you kindly tell me what quantity of turnips may safely be given to a newly calved cow which has just recovered from redwater, and also advise a cure for the latter?

The Live-stock Division:—

It is not advisable to give turnips in any quantity to a newly calved cow just recovered from redwater. This trouble, as we know it in your district, is described as the "parturient" form, and is the cause of considerable loss in dairy cows. It occurs shortly after calving, and, no blood-parasite so far having been demonstrated, is believed to be due to excessive feeding on turnips in the late winter and early spring months. Turnips consist of over 90 per cent. of water, and it is plain that if they form the greater part of the diet this will be of a very innutritious nature. Consequently the cow falls off in condition, a great demand being made upon her body to nourish the unborn calf. The blood becomes impoverished, and when parturition takes place its condition becomes such that it parts with its colouring-matter while passing through the kidneys, thus giving the urine a red or dark-red colour. The diet for a newly calved cow just recovering from redwater should include little or no turnips. It should be of a nutritious and easily digested nature, such as bran and linseed mashes, oatmeal or maize-meal, gruel, good hay and grass, and green feed if obtainable. Turnips should at all times be looked upon as merely a subsidiary article of diet for a dairy cow,

and a daily allowance of not more than 23 lb. given. Regarding a cure: red-water being a very fatal disease, prevention rather than cure should be aimed at, so during the winter months and later months of pregnancy the cows should be provided with a liberal quantity of good fodder with their turnips. The medicinal agents used are many and various. In the early stage of the disease an administration of from 8 oz. to 10 oz. of common table salt is often followed by good results. This should be given dissolved in a quart of warm water with 1 lb. or 2 lb. of treacle. Repeated doses of salt, Epsom salts, and Glauber salts should, however, be avoided, as they cause depression and stomach irritation. If constipation is a marked symptom, full and repeated doses of linseed-oil should be administered. This may be followed by ounce dozes of powdered gentian three times daily. A mixture of switched eggs and milk is beneficial, and has been credited with many cures. Three eggs are switched in a quart of milk and given every three hours.

NON-BEARING CHERRY-PLUM TREES.

"NEW-CHUM," Carterton:—

Could you advise treatment for ten-year-old cherry-plum trees which are white with blossoms every year yet bear no fruit?

The Horticulture Division:—

The failure to bear fruit may be due to one of many causes, or to a combination of causes. Frost is a frequent cause of such failures. An abnormal quantity of blossom may indicate lack of vigour in the tree—the blossoms may be imperfectly developed. In such cases the flowering twigs should be shortened back, the weaker twigs to an inch or two, stronger ones in proportion (perhaps one-third, half, or two-thirds), the weaker growths being cut hardest. This will strengthen the blossoms left. If the trees are crowded whole branches should be taken out so as to let light into the tree. If the soil is wet it should be drained. The soil should be cultivated and weeds suppressed. These things being attended to, give the trees a fertilizer composed of from 2 lb. to 4 lb. of superphosphate, according to size of tree, and 1 lb. of sulphate of potash. These are to be applied at once, and 1 lb. nitrate of soda when growth has commenced. If growth is fairly strong omit the nitrate of soda and give instead 1 lb. of sulphate of ammonia, to be applied at the same time as the super and potash.

INKWEED ON BUSH CLEARINGS.

J. S. MASON, Te Kuiti:—

I should be glad of advice regarding inkweed, which grows in bare spaces, and particularly in a three-year-old bush-burn, on my land. Will the weed die out in time, or what means should be taken to eradicate it?

The Live-stock Division:—

This weed is not considered to be a serious menace. It is quite a common occurrence to get a strong growth of this plant on new clearings, but it eventually disappears without any treatment.

SUPERPHOSPHATE FOR WHEAT AFTER LIMING.

J. L. G., Marton:—

Please inform me if it would be advisable to use superphosphate when sowing wheat, after having limed the ploughed ground.

The Fields Instruction Branch:—

Superphosphate would be quite a good manure for wheat in your district, particularly where the ground had been limed. Use from 1 cwt. to 2 cwt. per acre.

CONCENTRATES FOR COWS ON TEST.

"INQUIRER," Opunake :—

I have entered some two-year-old Jersey heifers for semi-official test, and would be glad of advice as to a suitable ration of concentrated foods to supplement ordinary pasture so as to secure best results.

The Live-stock Division :—

Best returns are got from a ration with a fairly wide nutritive ratio—about 1-7 (1 part of digestible crude protein to 7 parts of digestible carbohydrates); a heavy grain ration is not economical. A ration having once been decided upon should not be materially altered, and should contain about 2 lb. of digestible protein and 14 lb. of digestible carbohydrates. We would suggest the following to supplement the ordinary pasture: 5 lb. crushed oats, 2 lb. bran, 2 lb. linseed-meal, and 3 lb. cracked maize per day, to be fed half in the morning and half at night. The addition of a small handful of salt is recommended. Most farmers drench their cows a few days before calving, and it is not a bad practice.

SWEET CLOVER.

T. HANSEN, Norsewood :—

I should be glad of any information you can give me regarding sweet clover.

The Fields Instruction Branch :—

Sweet clover (*Melilotus alba*) is a biennial and grows fairly well in New Zealand, but owing to its bitter taste it is not relished by stock, although they will eat it fairly well once they have acquired a taste for it. It is sown at the rate of 15 lb. to 20 lb. of seed per acre, in the same way as red clover. Generally speaking, it is better to grow red clover than sweet clover in this country.

SCOURING IN HORSE.

"PONY," Waitotara :—

Will you kindly inform me of the best way to cure a fifteen-year-old mare of scouring, which has affected her for six months. She is used as a school pony, and is grass-fed. I have tried hay, but without result.

The Live-stock Division :—

Diarrhœa usually is due to one of three causes, or a combination of them: (1) Indigestion from eating unsuitable or improper feed and substances liable to produce an irritable condition of the digestive tract; (2) parasites—the small red worm in particular; and (3) irregularity or a diseased condition of the teeth. In treating, it would be well to satisfy yourself that neither of the two latter conditions is responsible, by making a thorough examination of the fæces and of the mouth. If due to improper food or water, these should be at once changed, and after starving the pony for twelve hours, ½ pint of raw linseed-oil should be administered. When the action is finished careful feeding should be resorted to with bran mashes, boiled linseed, or flour gruel. Where parasites are suspected one of the following powders might be given in a quart of cold gruel night and morning: Sulphate of iron, 1 dram; or soda bicarbonate ½ oz., powdered ginger ½ oz., and powdered aniseed ½ oz.

TREATING HORSE FOR WORMS.

G. L. ROGERS, Manaroa :—

Will you kindly advise treatment for a draught horse with worms?

The Live-stock Division :—

The medicines employed for killing or removing internal parasites differ according to the particular worm present. Presuming you refer to the common round worm of the horse (a worm averaging about 6 in. in length) the following

treatment is advised: At the week-end give a bran mash, and the following morning a full pint of raw linseed-oil to which has been added 1 oz. of turpentine. A sloppy mash should be given after this and the usual feed later. Place the animal in a paddock where the results of the dose can be noticed. Repeat in a fortnight if necessary.

FLIES ABOUT COW-BAILS.

F. C. M., Ngatapa :—

During the last milking season I was much annoyed with flies in my cow-bails. I sprayed the bails every night with Little's fluid sheep-dip to kill the flies, but this proved very expensive. Could you kindly tell me of a cheaper fly-repellant ?

The Live-stock Division :—

The first essential is that the bails and their immediate surroundings be kept clean, and all manure shifted away. As a spray I would recommend a mixture of 1 part agricultural formalin to 20 parts water. The roof and all corners of the bail should be sprayed two or three times a week during the time that flies are most prevalent. This should not, however, be done immediately before milking, as milk takes up the odour of formalin very readily.

NEW ZEALAND WOOL-MARKETING CONTROL.

THE following record of the events leading up to the issue of the Wool Industry Regulations and the control of marketing by the Wool Committee is contributed by Mr. T. R. Lees, Controller, Department of Imperial Government Supplies, who is the Government representative on and Chairman of the Committee :—

During March last the wool-market was rapidly falling, and negotiations were taking place between the Directors of "Bawra," the Colonial Wool Merchants' Association, in London, and the woolbrokers' associations in Australia and New Zealand, to devise means to restore confidence to the trade. It was pointed out that unless some agreement towards limitation of offerings and the fixation of minimum reserve prices was arrived at between the sellers of the old and new clips prices must continue to fall at each succeeding sale, as the demand was totally inadequate to cope with the quantities of wool that were being marketed.

The directors of Bawra, who were holding two and a half million bales of old-clip wool, as against a maximum new clip in Australia and New Zealand of 2,150,000 bales, maintained that they could not be expected to make the whole sacrifice required in continuing to hold their wool while the owners of the new clip were scrambling for the small available demand for wool. It was clear that competition between Bawra and the owners of the new clip for the small demand would lead to lower and lower prices, and would demoralize the buying-market for wool and all the products of wool.

At the end of March the market was at the lowest level yet seen. At the meeting of producers and allied interests convened by the New Zealand Board of Agriculture on 31st of that month the position was placed before the representatives, and the following resolutions were unanimously carried :—

(1.) That all Dominion sales be postponed for a period not exceeding two months, to enable negotiations to be undertaken as hereinafter specified.

(2.) That the Dominion Government, by Proclamation, prohibit sales of wool during that period either by auction or private treaty.

(3.) That negotiations be undertaken with the British Government, Bawra, and the Wool Importers' Association, London, to provide for limitation of offerings in England and Australasia, to correspond with the monthly consumptive demand.

(4.) That the allocation of wool to be offered as specified in No. 3 be in proportion to stocks held as follows: (*a*) Australian wool held by Bawra; (*b*) Australian wool clip, 1920-21; (*c*) New Zealand wool held by British Government; (*d*) New Zealand wool clip, 1920-21.

(5.) That minimum reserves be placed on all wool so offered on a parity basis, such to be agreed upon between Bawra, the Wool Importers' Association, London, and the council of the New Zealand Woolbrokers' Association.

(6.) That on account of the altered market conditions of late, efforts be continued to secure representation on Bawra with full power; but, failing such, that the representation as offered be accepted, leaving Mr. Massey to endeavour to correct the matter on his arrival in London.

(7.) That a representative with full Government recognition be sent to Melbourne forthwith to confer with Bawra on the foregoing lines.

These resolutions were promptly acted upon by the Producers' Committee and the Government. Under arrangement with the New Zealand Woolbrokers' Association all Dominion wool-sales were postponed for two months, and the woolbrokers and banks entered into a voluntary undertaking that wool shipped by them to London for sale on growers' account would not be sold at prices lower than those agreed upon between Bawra and the Wool Importers' Association, London. Mr. A. E. Mabin was also despatched to Melbourne with full Government recognition, to confer with Bawra, and supplied the Government and the Producers' Committee with very full details by each mail of the proposals of the Bawra board and of the Australian wool-growers' and woolbrokers' representatives.

The Australian wool-sales had been also suspended and were not reopened until 17th May, prior to which date the Commonwealth Government had enacted legislation prohibiting the export of wool from Australia unless sold at not less than the fixed minimum reserve prices, or unless the shipper puts up a bond that he will not sell the wool in London at less than the reserve prices plus charges. The minimum *average* reserve price in Australia was fixed at 8d. per pound. The New Zealand wool-sales were reopened on 27th May, at Wellington, and the month's series was conducted on the voluntary arrangement with woolbrokers to conform to the fixed minimum reserves.

Mr. Mabin returned from Melbourne on 26th May, and furnished to the Minister of Agriculture a valuable report (which has been circulated through farmers' organizations in the Dominion) on the position of the wool-market and the policy of Bawra in regard to the disposal of the accumulated Imperial and Australian stocks and of the current season's clip. This report was fully considered by the Producers' Committee, and the following resolutions were passed and forwarded to the Minister of Agriculture:—

(1.) That it is desirable and practicable in the interests of wool-producers, wool-users, banks, and financial houses, and generally advantageous to the wool industry of the Empire, that there be formed a board to be called "The New Zealand Wool Authority," to direct the wool-selling policy of New Zealand until such time as the market becomes normal. The Authority to consist of two woolgrowers, two woolbrokers, and one member to be nominated by the Government, and to be empowered to (*a*) regulate wool allocations for auction sales in New Zealand; (*b*) fix reasonable minimum reserves on New Zealand wool on a parity basis in New Zealand, Australia, and London; (*c*) formulate a policy to deal with carry-over wools, with power to act; (*d*) enter into such business and financial arrangements with Bawra, banks, or other bodies as may be found necessary or desirable.

(2.) That the Government be asked to issue an Order in Council under the Board of Trade Act, 1919, constituting the Authority with the necessary powers.

The Government decided that in the interests of the industry it was advisable to act on the recommendations of the wool-growers' conference and the Producers' Committee, and issued regulations (*a*) prohibiting the sale of wool at prices less than the minimum reserve prices fixed relatively to the average minimum reserve price to be gazetted; (*b*) prohibiting the export of wool which has been purchased at less than minimum reserve prices, or unless the exporter has given an undertaking that he will not sell the wool at prices less than the minimum reserve prices plus charges to point of delivery; (*c*) empowering the New Zealand Wool Committee to determine the maximum quantity of wool which may be offered for sale during any period; (*d*) fixing the minimum *average* reserve prices in New Zealand at 9d. per pound for wool of over 56's quality, and at 5d. per pound for wool of 56's quality and under.

The Government also appointed the Wool Committee, consisting of Messrs. O. J. Hawken and L. A. Rutherford, representing the wool-growers, Messrs. W. S. Bennett and A. E. Mabin, representing the woolbrokers, and Mr. T. R. Lees, representing the Government, to administer the regulations and to advise the Minister of Agriculture on all matters in connection with the disposal of wool.

SILO-CONSTRUCTION IN THE UNITED STATES.

USEFUL information regarding silo-construction was given in a paper by Mr. W. D. Hunt read at the recent annual conference of the New Zealand Council of Agriculture. Referring to a visit made by him last year to America, Mr. Hunt said :—

"What I saw of the agricultural life and doings in the United States was chiefly in the States of Minnesota, Wisconsin, Illinois, and Iowa. What, perhaps, struck me more forcibly than anything else was the use that they make of silos. It seems to me that we can take a lesson from them in this respect of advantage to ourselves, particularly in connection with our dairying industry. The silos are not met with just occasionally : they are literally there in thousands ; practically every farm has them. The modern silo is a circular erection built of reinforced concrete. The usual diameter is anything from 10 ft. to 20 ft., and they generally run in height from four to six times the diameter. The highest I saw was 90 ft. high, but I was told that they sometimes run considerably over 100 ft.

"I inquired as to the cost of building, and was amazed at the cheapness and rapidity with which they are constructed. They have a regular plant for erecting them. There is no boxing or carpentering work such as we are accustomed to in connection with concrete-work in this country. The whole thing is built in a steel mould. The plant consists of a tall steel mast, which is built in 10 ft. sections ; one section screws on to the top of another. This mast is first run up to the necessary height, stayed with wire ropes from the top, and made perfectly plumb. A circular mould 4 ft. or 5 ft. in height is then hung on to the mast, supported by arms running out from the mast. The mould is made to build a wall 6 in. or 8 in. in thickness, and there are places in it for putting in the reinforcing steel rods. The arms from the steel mast that support the mould extend out beyond the top of the mould, and from this extension hangs the platform that the workmen stand on. The concrete is mixed in a special concrete-mixer which goes with the plant, and which is driven by a 3 horse-power petrol-motor. The mould at first, of course, rests on the prepared foundation. The steel rods are put in place, the mixer set to work, and the concrete poured into the mould. To fill the mould is a day's work. This means 4 ft. or 5 ft. of wall for the first day. Next morning a few bolts are moved, which loosens the mould, and the whole thing is wound up the mast and placed in position for pouring in another lot of concrete. This can be done in about ten minutes. The mixer is set to work again. The concrete is hoisted by means of a pulley supported by the central steel mast. The hoisting-power is a friction-winch driven by the petrol-engine on the mixer, and the filling of the mould with concrete is just another day's work. Thus the silo goes up at the rate of 4 ft. or 5 ft. a day. Three men are all that are necessary to do the work, of which only one need be an expert in concrete and the other two can be any general labourers. With this plant the labour required to erect a silo, say, 16 ft. in diameter and 80 ft. in height is the work of three men for twenty-three days.

"A silo of this measurement, when filled, will hold 450 tons of ensilage, which is sufficient to provide 125 head of cattle with 40 lb. of ensilage per head per day for six months. A silo of this size would require for its construction 95 yards of gravel, 107 barrels of cement (equal to about 18 tons), and 4,159 lb., or a little less than 2 tons, of reinforcing steel rods. When it is finished the whole plant is moved away, and there is no waste of any kind left. All the farmer has to do is to buy his gravel, steel, and cement, hire the plant and the necessary labour, and the job is done. The silos can be built any size. What would be regarded in America as a very small one would be 10 ft. in diameter and 40 ft. in height. This would hold 70 tons of ensilage, which would be sufficient to feed nineteen head of cattle 40 lb. per head per day for six months. . . .

"I brought with me full details, showing material required and estimated cost of construction, for silos of almost any size or capacity. I put all the information before a firm of building contractors here who do a large amount of reinforced-concrete work. They were greatly taken with the plant and system of doing things, and thought that silos on this system could be erected very cheaply in this country. They told me that if they could get orders for, say, half a dozen silos they would import the necessary plant themselves for the work. The plant itself is not an expensive one. I have particulars of costs, and will give them to any one interested."

EXAMINATION OF FERTILIZERS.

THE Department's Chemist would value the assistance of farmers in examining the quality of the fertilizers on the market. For this purpose a portion of fertilizer should be taken from each of a number of bags and the portions thoroughly mixed together. Finally, a portion weighing about 1 lb. may be put into a clean dry tin, and posted with the invoice certificate or a copy of it, addressed to the "Agricultural Chemist, Dominion Laboratory, Wellington." It is essential that *the invoice certificate should accompany any sample sent.* Senders of samples will note that under this arrangement *the results of the examination cannot be supplied to them unless confirmed by an official sample.* If it is possible and the results warrant it an official sample will be obtained by the local Inspector from the vendor's store, which will enable legal proceedings to be taken should any deficiency be found.

LAND FOR DISCHARGED SOLDIERS.

THE following lands will be made available for selection by discharged soldiers during the next few weeks :—

Wellington : Eight sections on the Wanganui River, in Retaruke and Owatua Survey Districts, ranging from 214 acres to 729 acres, will be balloted for on 28th September. This land was formerly part of the Wanganui River Trust Domain, from which the reservation has been removed. The sections are well watered throughout, and the land will make good grazing and fattening country when cleared and grassed. Two sections, with a total area of 1,540 acres, situated about seventeen miles from Mangaweka, will be offered on 26th October. The general quality of the land is good.

Nelson : Eight sections in Matakitaki Settlement (about twenty miles from Murchison), ranging from 542 acres to 1,265 acres, will be offered on 3rd October. Taken as a whole, this settlement is suitable only for pastoral purposes, although most of the sections contain land which is suitable for dairying.

North Auckland : Eleven sections, in areas ranging from 15 acres to 470 acres, and twenty-one sections, in areas ranging from 8 acres to 617 acres, will be offered on 3rd October and 2nd November respectively.

FORTHCOMING AGRICULTURAL SHOWS.

Hawke's Bay A. and P. Society : Hastings, 19th and 20th October.
Marlborough A. and P. Association : Blenheim, 25th and 26th October.
Manawatu and West Coast A. and P. Association : Palmerston North, 2nd, 3rd, and 4th November.
Canterbury A. and P. Association : Christchurch, 10th and 11th November.
Waikato A. and P. Association : Hamilton, 15th and 16th November.
Wanganui Agricultural Association : Wanganui, 16th and 17th November.
Stratford A. and P. Association : Stratford, 23rd and 24th November.
Auckland A. and P. Association : Auckland, 2nd and 3rd December.
Hauraki A. and P. Association : Paeroa, 7th and 8th December.
Southland A. and P. Association : Invercargill, 13th and 14th December.
Woodville A. and P. Association : Woodville, 24th and 25th January.
Clevedon A. and P. Association : Clevedon, 4th February.
Feilding I., A., and P. Association : Feilding, 7th and 8th February.
Dannevirke A. and P. Association : Dannevirke, 8th and 9th February.
Rodney Agricultural Society : Warkworth, 18th February.
Marton District A. and P. Association : Marton, 1st March.
Ashburton A. and P. Association : Ashburton, 22nd and 23rd March.
Methven A. and P. Association : Methven, 30th March.
Temuka and Geraldine A. and P. Association : Temuka, 30th March.

(A. and P. Association secretaries are invited to supply dates and location of their shows.)